BasinGuide

A Guide to River Basin Planning

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AWP Knowledge Framework
The Australian Water Partnership is committed to enhancing sharing of knowledge and tools for sustainable water management to improve water planning, allocation and governance by governments, industries and civil society. This knowledge product supports the AWP Knowledge Strategy and contributes to the *Guide Series* under the Australian Bookcase. The other tiers within this bookcase are the *Australian Journey Series* and Australian Perspective Series. For more information, visit waterpartnership.org.au.

About the Authors
Alluvium was established in 2006 as a niche, employee-owned consulting firm focused on the sustainable management of catchments, rivers and cities. Alluvium has experience in delivering a broad range of services into the Asia-Pacific region with a focus on small to large scale water resources planning, water sensitive urban design and strategy, water resources modelling, climate change adaptation and understanding sediment movement in rivers.

Access Water Management brings 25 years' experience in water policy and planning, and water management at the highest-level including responsibility for development and implementation of significant water reform in Australia.

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Acknowledgement of First Nations Peoples

The partners of the Australian Water Partnership acknowledge, recognise and respect First Nations Peoples globally and across the Indo-Pacific region, and recognise the critical role they play in sustaining and protecting scarce and valuable water resources. As part of our role in sharing Australia's experience in water management, we seek to walk together with people across the region, sharing, listening, learning and working together to improve water management outcomes for all peoples.

In Australia, the Australian Water Partnership, Alluvium, University of Technology Sydney and Access Water Management acknowledge that since the Dreaming or time immemorial, Aboriginal Peoples have owned and occupied the land and waters, including the Murray-Darling Basin Area. This continuing occupation was, prior to dispossession, typified by active and sustainable management of Country – land, water and all natural resources were owned and managed for the spiritual, cultural, environmental, social and economic benefit of generation after generation.

The harm and enduring injustices wrought by the forced dispossession of Aboriginal Peoples from their lands is evident in both the Aboriginal communities and the natural environment of the Basin Area, and cannot be denied. Even in such circumstances, the ongoing significance of land, water and the natural environment (including all of its resources) to the lives of Aboriginal Peoples of the Basin Area also cannot be denied.

The Australian Water Partnership, Alluvium, University of Technology Sydney and Access Water Management honour the past, respect the present, and are committed to a reconciled and prosperous future where First Nations Peoples – including Aboriginal and Torres Strait Islander interests in water – can realise their full potential.

Reflecting a wide range of perspectives

Development of this guide ('BasinGuide') has involved the engagement of a wide range of Australia's water expertise. This includes people closely involved in development and implementation of basin plans and other water sharing plans in Australia as well as those with experience internationally.

BasinGuide also integrates a wide range of perspectives including national and state government agencies, Indigenous (First Nations) Peoples, communities and environmental advocates. This has resulted in support and consensus across sections of the Australian water sector that the BasinGuide is reflective of the Australian basin planning experience whilst maintaining relevance for customised application in other countries of the Indo-Pacific and beyond.

Summary version of BasinGuide

A summary version of BasinGuide has been developed to accompany this full version. The purpose of the summary is to provide a more easily accessible document that practitioners can use as an entry point to the full guide. The BasinGuide summary is available at https://waterpartnership.org.au/our-offering/river-basin-planning/).

Executive Summary

The challenge

Without water people cannot live. Yet over two billion people live in countries experiencing high water stress and this could increase to almost three billion by 2030 (United Nations, 2018; GWI, 2013). As human populations increase and countries industrialise, demand for water increases, whilst water availability decreases through overuse, pollution and a changing climate. Disputes arise between people at local, national and international levels because lives and livelihoods are threatened.

Ensuring that there is enough water of the appropriate quality to support growing populations is a significant challenge for communities and governments across the world. The often ad-hoc growth of water consumption and strategies to meet water demands needs to evolve to ensure that existing and future water needs can be met despite a rapidly changing climate.

River basin planning — a part of the solution

Only people can solve the complex challenges of sharing water to sustain lives and livelihoods. There are no magic tools to do it for us. Local knowledge and technical information inform the necessary conversations and negotiations and river basin planning offers a framework to facilitate the process and support all of the stakeholders to transparently reach agreement on what is reasonable.

River basin planning is an important tool for facilitating the debate required to resolve what is firstly a people challenge and secondly a water challenge. It provides a process whereby people can be involved in a collaborative way to examine the demand, supply and quality of water resources in an integrated, long-term and geographically specific context. By establishing plans and governance mechanisms to distribute water resources, manage water challenges such as flood and droughts as well as resolve and manage water disputes, basin planning can provide a pathway to transparently managing increasingly limited and contested water resources.

Understanding and managing the different needs and interests of the many water users in a basin is a major function of river basin planning. The process of basin planning facilitates governments, water users and other stakeholders to agree on the state of the water resources and approaches to resolve problems together with an ongoing process for addressing water needs. Reaching agreement on the decision-making process and governance arrangements provides stability and predictability that supports economic and social development, whilst enabling environmental sustainability.

Australia's experience in river basin planning

Australia continues its journey of dealing with increasing water demands in a highly variable and changing climate. Communities have demanded that Australia respond to water scarcity and quality as life, livelihoods and the environment have been threatened. A critical component of the response has been an ambitious basin planning process, focused largely on the Murray-Darling Basin, but also including basin planning initiatives across the continent.

Australia's basin planning takes place in a federal constitutional framework, where states have constitutional responsibility and jurisdiction for land and water management. The Australian national government has a national leadership role on some matters, while on other matters state governments agreed to collaborate with, or have referred limited powers to, the National Government (in Australia this is referred as either the Commonwealth or Federal Government). Although challenges in implementation

remain, Australia's experience can offer a range of lessons and is an example of one approach that is iteratively being undertaken by a country and its communities committed to river basin planning and implementation.

Acknowledgment and recognition of Indigenous Peoples

Indigenous (First Nations) Peoples across the world hold deep connections to their rivers and groundwater, with knowledge based on thousands of years of experience. Engagement with Indigenous Peoples must be respectful, directed by them, free of coercion, and must provide adequate time for meaningful engagement and consultation. Engagement must provide Indigenous Peoples with the opportunity to provide 'free, prior and informed' consent, before any changes to water use, water bodies, and the ecosystems on which they depend are made. In Australia, there is increasing engagement with Aboriginal and Torres Strait Islander Peoples to manage water resources and there have been some important achievements, as shown in the case study below. However, important work remains to be done to ensure Indigenous Peoples have appropriate legal entitlements to water.

Purpose of BasinGuide

This guide to river basin planning is intended to be a reference for government and non-government practitioners undertaking river basin planning in the Indo-Pacific region. This guide draws on basin planning and other types of water planning experiences in Australia, as well as the experience of Australian practitioners working internationally.

Whilst this document has drawn on the Australian perspective, it is recognised that water planning drivers will be different in every country. For example, a focus on planning for drought and critical human water needs may not be a priority in all countries, but instead a focus on flood management, water quality or fairer distribution of water resources between different users and the environment may be more relevant. Therefore, whilst this guide draws on the "lessons learned" in Australia, experiences from other countries are equally useful and have also been included.

To enable BasinGuide to be as concise as possible, it focusses on surface water sharing aspects of basin planning. The importance of groundwater, water quality, flooding, navigation and of other drivers and approaches for planning are recognised within this guide, but discussion of these is limited.

Key to implementing the framework effectively is understanding the perspectives of those reliant on water resources for their lives and livelihoods and adjusting the process accordingly. Achieving engagement and confidence of water users and communities is more likely to lead to better water resource management.

BasinGuide is intended to be used at a range of levels of government, from Ministerial to officers designing and implementing policy, as well as at provincial, regional, State and national levels. This guide is also intended to support non-government organisations, community and stakeholder groups who are integral to river basin planning processes.

Seven key steps for river basin planning

In this guide, river basin planning is simplified into seven stages, each framed by a guiding question (Figure ES1). These can be seen as steps, although they should not be considered as consecutive, and all seven need to overlap and iterate to some degree throughout the process of river basin planning and management.

1. **Initiate — Why do we need to do this and how do we get started?** *Initiation and visioning*;
2. **Ongoing engagement — Who needs to be involved?** *Engaging stakeholders and the community*;
3. **Governance — Who makes decisions and who is responsible for what?** *Enabling governance, policy and legislation*;
4. **Situation assessment — Where are we now?** *Assessing current status and trends for surface and groundwater*;
5. **Plan — How do we plan, consider options and decide strategies?** *Considering options, strategies, trade-offs and decision making*;
6. **Implement — How do we make it happen?** *Implementation of river basin plans, ongoing management and compliance*;
7. **Monitor and evaluate — How do we adapt and learn?** *Monitoring, evaluation, reporting, adaptive management and learning.*

Figure ES1. Stages and guiding questions for basin planning

Each of the seven stages and guiding questions are further described in the chapters of this guide, together with suggested key considerations and examples. The key outcome of each stage is outlined in Table ES1.

Table ES1. Key outcomes of each stage for basin planning

Stage	Description	Guiding question	Key outcomes
1. Initiate	Initiation and visioning	Why do we need to do this and how do we get started?	• The case for action and the drivers to carry out river basin planning are clear. • Identified the values that each of the stakeholders are looking to protect. • Network of support built for river basin planning. • Basin vision and values developed with community and stakeholders. • Worked with stakeholders to establish long-term objectives that translate a basin vision into specific aims for a plan to achieve, within a specified timeframe and available resources.
2. Ongoing engagement	Engaging stakeholders and the community	Who needs to be involved?	• Trust built between all parties as well as a shared understanding of key issues. • All relevant stakeholders involved in the planning process, thereby increasing the knowledge base upon which the plan is built. • Built stakeholder and community capacity to participate. • Management of risks that arise from inadequate understanding of community needs and water uses.
3. Governance	Enabling governance, policy and legislation	Who makes decisions and who is responsible for what?	• Enabling legislation established. • Enabling policy and regulatory framework established. • Institution/s empowered with oversight and/or authority to develop and implement the basin plan. • Clarity on what can be negotiated with stakeholders, what is not negotiable and where stakeholders are asked for input, but decisions rest with governments.
4. Situation assessment	Assessing current status and trends for surface water and groundwater	Where are we now?	• Agreed foundation information and understanding of the basin established in a situation (or state of the basin) report including local knowledge. • Process established to actively engage and involve —as well as make information available to — all stakeholders. • Developed basis for hydrological and other computer models that will later be used to assist river basin plan decision making. Ground truthed with local stakeholders. • Present and future water supply and demands quantified. • Major and agreed issues of common concern identified.

Stage	Description	Guiding question	Key outcomes
5. Plan	Considering options, strategies, trade-offs and decision making	How do we plan, consider options and decide strategies?	• Basin plan supported by a transparent decision-making process and supporting information. • Basin plan developed, outlining strategies to achieve the agreed basin objectives and vision. • Agreement from stakeholders and relevant governments on the options/strategies outlined in the plan including identification of the trade-offs and who wins/loses, with general support in the broader community. • Mechanisms agreed to compensate stakeholders that are negatively impacted by the plan.
6. Implement	Implementation of river basin plans, ongoing management and compliance	How do we make it happen?	• Clear decision-making process and governance framework is put in place with well-defined responsibilities, adequate resources (budget) and accountability for basin plan implementation and review. • Engagement with and input from community stakeholders continues. • Ongoing community programs, regulation, compliance and enforcement to ensure the plan is implemented.
7. Monitor and evaluate	Monitoring, evaluation, reporting, adaptive management and learning	How do we adapt and learn?	• The basin plan clearly establishes the timing and focus of formal reviews of its progress and outcomes. • Measured success of the plan against established targets and performance indicators. • Monitoring, audit and evaluation triggers action when a part of the plan is found to be underperforming or implementation is lacking. • Relevant information is available to evaluate progress, report to the community and review the plan.

Lessons for river basin planning

These key lessons for river basin planning are covered in BasinGuide:

1. **Inclusive engagement is core to the process:** Genuine engagement with all stakeholders (including Indigenous Peoples, minorities, women, people with disabilities, and other marginalised people) is needed, with a focus on transparency, genuine consultation and fairness.
2. **Critical human water needs:** This should be overtly recognised as the highest priority use of water as a result of early discussion about values between stakeholders.
3. **Capacity building and genuine engagement of Indigenous Peoples interest groups:** Creating a greater understanding and confidence for Indigenous Peoples to actively participate in water planning, management and water forums will enable cultural knowledge to be included and Indigenous cultural, social, economic and environmental outcomes to be achieved.
4. **A commonly developed basin vision sets the tone:** The basin vision is a description of the desired long-term state of the basin. It results from the sharing of the values held by stakeholders (e.g. quality drinking water, abundant fish, enough irrigation water, hydropower and other values). Develop the vision with the engagement and agreement of all relevant stakeholders. The vision will provide guiding principles and direction to the planning process but is often aspirational, rather than specific.
5. **An appropriate governance enabling environment can be the basis for success:** Institutional arrangements involving organisations with the management and technical capacity to effect change are essential if a river basin plan is to be developed and implemented. However, a basin plan can be initiated even if all data and modelling tools are not yet available — if the government and communities recognise the need for change, then the process should commence and remain adaptive over time as information and data improves.
6. **It is critical to understand the specific basin context:** It is important that basin planning is informed by a 'situation assessment', telling us "where are we now?" These can be a 'state of basin assessment' or a description of resources (including water) and the social, political, economic and environmental context. The situation assessment is informed by a range of experts and stakeholders so as to capture the complexity of the system, and interrelationships between important factors. Local knowledge is a critical input. Agreement on a single source of truth for the data will avoid ongoing conflict over who is right.
7. **Options need to be assessed against clear criteria:** Identify options for strategies that could contribute to achieving the basin objectives and vision. These options may include limits to extraction, water sharing arrangements, demand management, supply management (including water infrastructure), measures to improve water quality, measures to support ecosystems and ecosystem services, such as fisheries. Ideally, each of these should be assessed against clear criteria, agreed between all stakeholders and linked to the objectives.
8. **Each option will involve trade-offs between individuals, between sectors and between social, economic and environmental goals:** There will be winners and losers. These trade-offs must be articulated clearly and mechanisms designed to offset the impact for those negatively impacted. This may include industry and community structural adjustment processes and financial support for the changes likely from a basin plan. Failure to do so results in future conflict and resistance to plan implementation.

9. **The best set of strategies for each river basin will depend on the basin vision and objectives compared to the current basin context:** A combined set of strategies encompassing the following is relevant for most basin planning contexts where sharing the water resource is the focus: i) establishing and protecting 'system needs'; ii) allocating remaining water between users; and iii) supporting water users to operate within their available water allocation (more information provided in Box E1).
10. **A clear governance framework is needed for plan implementation and compliance:** To implement a river basin plan, a clear decision-making process and governance framework needs to be put in place. This should include well-defined responsibilities, adequate resources (budget) and accountability for basin plan implementation and review. Ensuring compliance with measures agreed in the plan is critical to maintaining fair and transparent implementation. Basin communities need to be engaged in implementation, for example, through oversight of compliance or local community action projects.
11. **Monitoring, evaluation, reporting and learning (MERL) must be a priority during implementation:** This should be systematically integrated into planning, implementation, reporting and decision making, not simply a separate project-based effort every few years.

Box E1: A set of strategies for sharing water within a basin plan

Establishing and protecting 'system needs' forms the basis of water allocations: System needs are the flow and quality requirements that are essential for non-consumptive (or non-extractive) purposes such as environmental and cultural purposes and in-stream production needs (e.g. fisheries), as well as for extraction for critical human water needs for drinking, sanitation and domestic food production, for navigation and for water quality. Being able to demonstrate how protecting system needs underpins consumptive use is critical. Having a healthy river means that water quality is high and consumptive users will be able to access their allocations over time. Protecting river system needs is protecting people's needs on a sustainable basis.

Allocating water between users provides certainty to water users: Once the system needs and system flows are established, it is important to establish a corresponding limit to extractive uses and allocations to water users. This limit and allocations provide the basis for certainty for those depending on system needs and flows, while also providing stability and certainty for users within the extractive share. Maintaining extractions below the set limit and within allocations requires ongoing monitoring and reporting, as well as a clear mechanism for maintaining compliance.

Water users need to be supported to operate within their available water allocation: Once water has been allocated between users, strategies are needed to support water users to operate within their allocation. Industry and community structural adjustment processes and financial support are required to smooth the inevitable changes likely from a basin plan. Demand management strategies provide incentives and tools for water users to reduce their water use through using it more effectively and efficiently. Supply management strategies increase availability of water or improve reliability of access to water.

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1 Introduction

1.1 The challenge — people and water

Without water people cannot live. Yet over two billion people live in countries experiencing high water stress and this could increase to almost three billion by 2030 (United Nations, 2018; GWI, 2013). As human populations increase and countries industrialise, demand for water increases, whilst water availability can decrease through overuse, pollution and a changing climate. Disputes arise between people at local, national and international levels because lives and livelihoods are threatened.

Ensuring that there is enough water of the appropriate quality to support growing populations is a significant challenge for communities and governments across the world. The often ad-hoc growth of water consumption and strategies to meet water demands needs to evolve to ensure that existing and future water needs can be met despite a rapidly changing climate.

As part of addressing these challenges, many countries have committed to addressing the Sustainable Development Goals (SDGs), including SDG 6 (Ensure availability and sustainable management of water and sanitation for all) which calls for 'by 2030, implement integrated water resources management at all levels, including through transboundary cooperation as appropriate' (SDG 6.5).

1.2 River basin planning — a part of the solution

Only people can solve the complex challenges of sharing water to sustain lives and livelihoods. There are no magic tools to do it for us. Local knowledge and technical information inform the necessary conversations and negotiations and river basin planning offers a framework to facilitate the process and support all of the stakeholders to transparently reach agreement on what is reasonable.

River basin planning is a critical tool for addressing the Indo-Pacific's water challenges, including Australia's, and achieving the SDGs. River basin planning helps facilitate the debate required to resolve what is firstly a people challenge and secondly a water challenge. It provides a process whereby people can be involved in a collaborative way to examine the demand, supply and quality of water resources in an integrated, long-term and geographically specific context.

By establishing plans and governance mechanisms to distribute water resources, manage water challenges such as water quality, flood and droughts as well as resolve and manage water disputes, basin planning can provide a pathway to transparently managing increasingly limited and contested water resources.

Basin planning provides a pathway to managing limited and polluted water sources by establishing plans and governance arrangements to distribute water resources, resolve water disputes, improve water quality, meet energy needs, mitigate floods and adapt to climate change.

Key to implementing river basin planning effectively is understanding the perspectives of those reliant on water resources, water quality and water-dependent ecosystems — such as fisheries — for their lives and livelihoods. Achieving engagement and confidence of water users and communities is more likely to lead to better water resource management and achieve the objectives sought.

1.3 Purpose, scope and audience of BasinGuide

This guide is intended to be a reference for practitioners undertaking river basin planning in the Indo-Pacific region. It draws on basin planning as well as other types of water planning experiences in Australia, as well as the experience of Australian practitioners working internationally. While this

guide draws on the "lessons learned" in Australia to identify guiding principles, experiences from other countries are equally, and sometimes more, useful to consider when planning an approach to managing basin and transboundary water resources. The lessons learned have been developed from drawing on Australian experts (the authors), an expert workshop held in 2019 which drew together river basin planners, managers and policy experts from across the country, and a number of expert reviewers.

Given the theme of planning for river basins, this guide focusses mainly on surface water planning whilst recognising the importance of groundwater-surface water interactions and of the need to undertake similar groundwater planning. Many of the principles and approaches in this guide will also apply to planning of groundwater resources. However, this guide does not cover the specific and technical aspects of groundwater planning.

Basin planning is often used to address the challenges of transboundary water management. River basins and groundwater systems' boundaries often do not coincide with administrative boundaries for nations, countries, states, provinces and other administrative units. In this guide 'transboundary' refers to planning across all types of administrative boundaries (i.e. national or sub-national)[1]. However, while the principles in this guide can be applied to international river basins, the geopolitical and diplomatic relationships aspects of international basin planning are not specifically covered in this guide.[2]

BasinGuide is intended to be used at a range of levels of government, from Ministerial to officers designing and implementing policy, as well as at provincial, regional, State and national levels. This guide is also intended to support non-government organisations, community and stakeholder groups who are integral to river basin planning processes.

BasinGuide is intended to be comprehensible by people without a detailed technical understanding of water issues. For this reason, this guide avoids technical and policy jargon where possible and, as far as possible, avoids terms that are specific to Australian usage. Innovations that are very specific to Australia are not described here in detail, as they may not be applicable for every basin internationally. These include the development of water rights and entitlements in law, separate from land title, that are specific, tradeable, and useable as security, together with an accompanying water market. However, these innovations inform a set of underlying principles outlined in this guide that are applicable more widely, such as establishing system needs (flow requirements that are essential for environmental and cultural purposes, in-stream production (e.g. fisheries), and critical human water needs), establishing a limit to consumptive extractions and then distributing shares within the consumptive limit.

Whilst this document has drawn on the Australian perspective, it is recognised that water planning drivers will be different in every country. For example, a focus on planning for drought and critical human water needs may not be a priority in all countries. Instead, a more relevant focus for some countries and basins may be on fairer distribution of water resources between different users and the environment, addressing energy needs, treatment of water and wastewater, mitigating pollution or mitigating floods. Whilst these issues are all addressed to some degree in this guide, it places a stronger focus on surface water (rather than groundwater) and on sharing of water resources (rather than flood mitigation and pollution).

Critically, in most basins there will be a need to debate and agree on the right balance of effort across several objectives. In addition, different circumstances may demand actions by governments, by communities or various combinations of both. The right approach will always need to be fit for

1 Note that the United Nations defines transboundary waters as "the aquifers, and lake and river basins shared by two or more countries" (https://www.unwater.org/water-facts/transboundary-waters/). However, we have chosen to take a broader definition for this BasinGuide, including subnational boundaries, such as State boundaries in federal governance systems.

2 Useful principles for river and groundwater resources crossing international boundaries include the Helsinki Rules on the Uses of the Waters of International Rivers (International Law Association, 1967), the Berlin Rules (International Law Association, 1992); the UN Watercourses Convention: 1997 Convention on the Law of the Non-navigational Uses of International Watercourses; and the UNECE Convention: 1992 Convention on the Protection and Use of Transboundary Watercourses and International Lakes.

purpose and fit for the context. Policy reform always starts with what is currently in place, from which the pathway must be mapped to solutions feasible in the local and regional context. Therefore, whilst this guide is principally based on the Australian experience, it is also equally informed by experiences from other countries, particularly in the Indo-Pacific region.

1.4 Why do river basin planning?

River basin planning provides a process, and ultimately a plan, to consider and manage competition and conflict in sharing access to benefits from the water resources of a river basin and mitigating risks such as droughts and floods. Managing water resources can result in a "tragedy of the commons", where users of a common pool resource focus on their own needs to the detriment of the shared resource. People may not naturally identify the need to collaborate to manage the resource sustainably until they understand, for example, upstream impacts on downstream users. At the scale of a river basin (whether within a state/province or across many states/provinces), this is even more probable as resource users are separated from others dependent on the resource by distance, jurisdiction and often by culture and language.

River basin planning recognises that water resources and the consequences of their management operate across the boundaries of countries, nations, states/provinces and other political and administrative units. A river basin plan therefore aims to manage a basin as a whole hydrological system. Benefits of this approach can include:

- Bringing communities together to understand and address issues of common concern;
- Integrating Indigenous cultural knowledge, values and perspectives into water planning and management;
- Assessment, planning and managing water resources by hydrological surface and groundwater boundaries, rather than political or administrative boundaries, can better anticipate the consequences of water management and development within connected and shared water resources;
- Delivering whole-of-basin solutions that are co-developed with communities, paying attention to the needs of marginalised peoples;
- Providing a process and framework to make clear decisions about the most appropriate distribution and management of water resources between multiple demands;
- Establishing a process and forum to negotiate and resolve/manage competing upstream-downstream demands and conflicts;
- Increasing water security and certainty of water management across an integrated system;
- Recognising the central role of water resources in food, health and energy needs;
- Sharing water for critical human needs including drinking water and sanitation;
- Sharing water for multiple broader economic benefits including agriculture, industry, power, navigation and fisheries, rather than planning for one sector not considering impacts on another;
- Considering the importance of water resources for cultural and spiritual needs;
- Considering environmental water needs to support ecosystem services, biodiversity, fisheries and other wild food sources;
- Providing a process and framework to review and improve over time;
- Providing ongoing processes for stakeholder input;
- Enabling community action to address issues;

- Enabling consideration of the relationship between food production, energy production and availability of water (the food-energy-water nexus); and
- Supporting implementation of Sustainable Development Goal (SDG) 6 and other relevant SDGs.

Managing the inherent conflicts of interest of the many users of a river basin water resource is a major function of river basin planning. Conflict at some level is inherent and inevitable. Yet it is possible for river basin planning to facilitate agreements that governments, water users and other stakeholders can accept as a reasonable and ongoing process for addressing their water needs. Reaching this agreement provides stability and predictability that supports economic and social development, as well as environmental sustainability. It enables lives and livelihoods to be sustained.

1.5 Guiding questions for river basin planning

River basin planning can be simplified to seven stages, each framed by a guiding question (Figure 1). These can be seen as steps, although they should not be considered as necessarily consecutive, and all seven need to overlap to some degree throughout the process of river basin planning and management. Basin planning is an ongoing cycle of adaptive management, engaging with risk and decision making with current knowledge, while building knowledge over time, in order to review and adapt.

The seven stages and guiding questions are:

1. **Initiate — Why do we need to do this and how do we get started?** *Initiation and visioning*;
2. **Ongoing engagement — Who needs to be involved?** *Engaging stakeholders and the community*;
3. **Governance — Who makes decisions and who is responsible for what?** *Enabling governance, policy and legislation*;
4. **Situation assessment — Where are we now?** *Assessing current status and trends for surface and groundwater*;
5. **Plan — How do we plan, consider options and decide strategies?** *Considering options, strategies, trade-offs and decision making*;
6. **Implement — How do we make it happen?** *Implementation of water plans and ongoing management*; and
7. **Monitor and evaluate — How do we adapt and learn?** *Monitoring, evaluation, reporting adaptive management and learning.*

1.6 Linkages to WaterGuide

AWP published WaterGuide as an organising framework for improved water management and use in response to water scarcity (Aither, 2018). It is intended to be used primarily by national or local governments in countries where water scarcity is a present or future threat to human health and wellbeing, economic development and/or environmental sustainability.

Whilst there are clear similarities between the stages outlined in WaterGuide and BasinGuide, they are intended to operate at different scales. This basin planning guide is intended to provide a more detailed insight into how to implement basin-scale planning rather than national- or state-scale water reforms, which ideally are complementary to the process of river basin planning. The two guides and approaches are therefore interlinked, and complementary, and each deal with necessary governance arrangements at a range of scales for integrated water management.

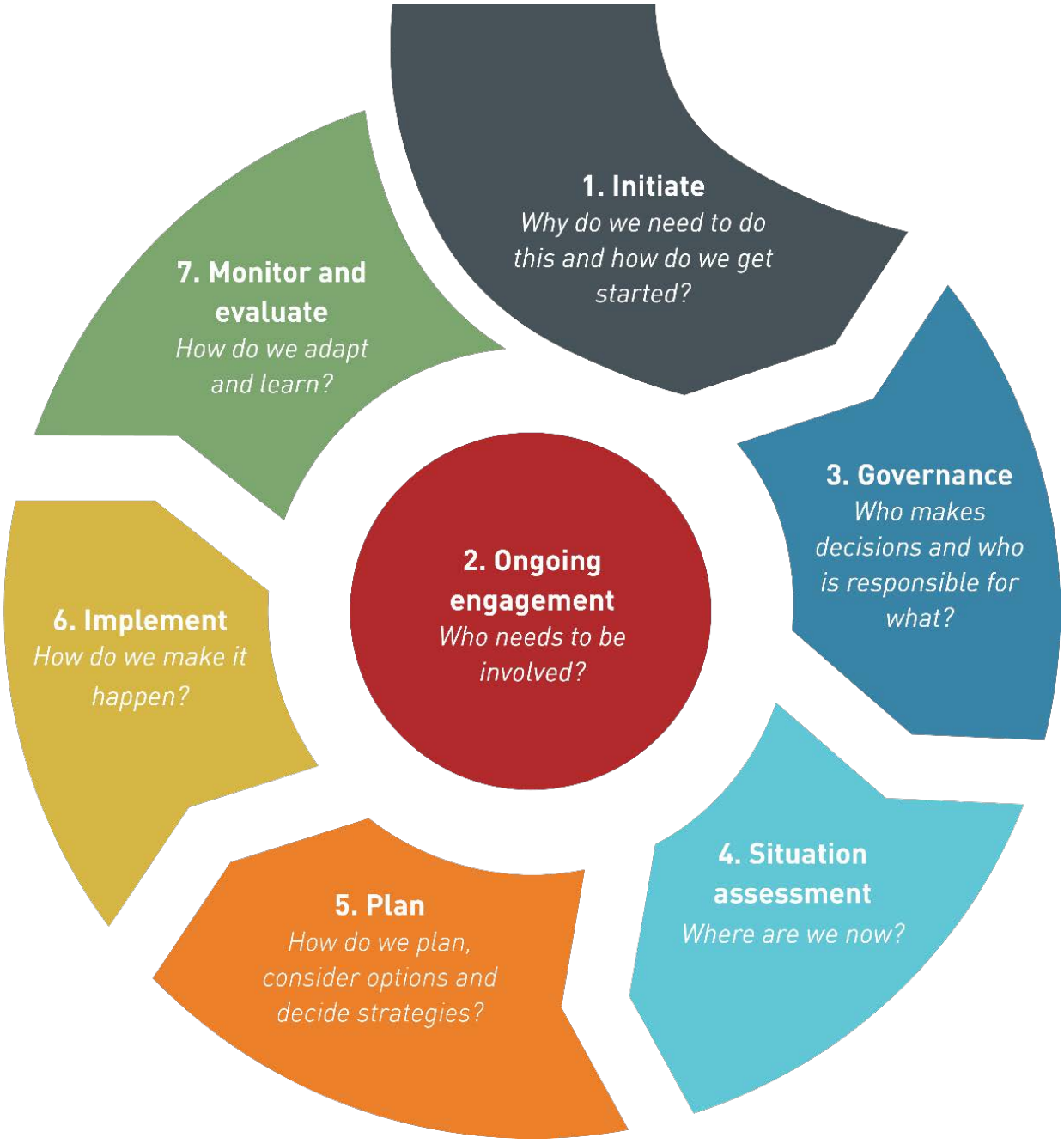


Figure 1. Seven stages and guiding questions for basin planning

2 Stage 1. Initiate — Why do we need to do this and how do we get started?

Initiation and visioning

Key actions

- Work with communities and advocacy groups to articulate why basin planning is needed and ensure sufficient consensus to initiate a process.
- Initiate the planning process and build a network of support and acceptance of the need for river basin planning.
- Seek political leadership and support between all relevant political stakeholders for a basin plan.
- Seek to transparently identify and assess the values and objectives of all stakeholders, and engage stakeholders in establishing a basin vision.
- Develop long-term objectives with stakeholders, to translate the basin vision into specific aims for the plan to achieve within a specified timeframe and with available resources.
- Understand the technical, engagement and communication skills and capabilities of the institutions responsible for basin planning.

Key outcomes

- The case for action and the drivers to carry out river basin planning are clear.
- The values each of the stakeholders are looking to advance are identified, and shared values understood from the outset.
- Network of support built for river basin planning through early engagement and discussion of values.
- Basin vision, values and long-term objectives developed with community and stakeholders.

2.1 Rationale

Initiation of river basin planning is the beginning of the process. The initiation of the river basin planning process is a critical stage for building an influential network of support amongst stakeholders, an agreement in principle that a process of river basin planning is necessary, and development of a shared vision and shared objectives. Gaining in-principle and public support by political leaders can help create the space for community and stakeholder engagement, gathering of information, and negotiation and decision making on key elements of the basin plan. Alternatively, the community may drive and initiate the river basin planning process, including by driving political and government agency action. Agencies should be alert to the sentiments of the water dependent communities. Education is a critical tool to enable communities to understand any need for change, and how they can contribute to developing and informing that change process.

Another important component of initiating the river basin planning process is to engage with the community to develop an overall vision of managing a river basin that is informed and shared by the community at large. More specific objectives can then be developed in consultation with community and other stakeholders. These more specific objectives might make a statement about the balance between various benefits and impacts from use of the basin water resources. For example, the objectives may state the environmental, social, economic and cultural outcomes sought from the basin plan.

Depending on the basin context, it may be important at this early stage to identify which agency is most appropriate to lead river basin planning. In some cases, it may be appropriate to identify more than one provided governance is clear. In some cases, the water agency may need to ensure that hydropower, treasury or other critical sectoral planning agencies are involved in endorsing decisions and the pathway forward. These objectives will evolve from discussions about what is valued by each of the sectoral interests. Without values discussions, objectives set by technical participants may be challenged in the future. Communities and individuals talk about values, scientists and engineers talk about objectives — the two have to be brought together.

2.2 Critical considerations

2.2.1 Drivers for initiation

While river basin planning can be undertaken proactively to manage future challenges, it is usually initiated in response to resource competition, such as conflict over access to, or poor quality of, a water resource. Initiation may occur in a range of circumstances, for example, due to stakeholder pressure, environmental degradation, crises such as drought or floods, water management disputes, funding drivers, or leadership changes in government.

Case study: Drivers for basin planning initiation

In Australia, drivers for river basin planning have included both community pressure and government action leading to ongoing national water reforms. Causes for the calls to action have included environmental decline, severe drought and increasing competition for available water for irrigation and water use industries. In Australia, states have the lead role in water legislation and management, while the National Government (legally called the Commonwealth) has powers for certain matters outlined in the Australian Constitution. In order to support and influence the states in their role of managing the resource, the national government drew on its constitutional powers to protect certain environmental assets and set up a range of incentives and policy drivers, including conditional funding from the National Government, multilateral and bilateral agreements. In addition, the national and states government negotiated an agreement for the states to refer some limited powers to the National Government.

Lower Darling in December 2019 (credit: D. Winfield)

Building a network of support

At this early stage, identification of all stakeholders with a legitimate interest or dependency on the water resources will help to ensure that all the relevant issues are included, and that a suitable strategy is developed to engage the community. Community and political leadership and agreement is a significant enabler for coordinated action at the river-basin scale. For example, although there are a range of views on the need for, and effectiveness of, the Murray-Darling Basin Plan, community engagement and leadership were critical in the initiation and development of the plan. When engagement was not prioritised, issues arose with respect to stakeholders' confidence in the process, which had significant implications for the development of the plan.

Once the decision is taken to initiate a planning process and stakeholders are identified, experience has shown that a first step is to build a network of support, including amongst key leaders in the community, industry and governments. Water resource management professionals in state, regional or national governments can play a key role in building understanding and support for the concept. At an early stage, identify all the stakeholders with an interest in the water resources of the river basin. Small, face-to-face meetings allow discussion of new ideas and the identification of common issues. They build a consensus and generate support for larger meetings, negotiations, workshops or conferences involving all parties.

Use plain language and avoid technical or bureaucratic terms when establishing forums for Indigenous interest groups. Usage of images (pictures) can be an effective engagement tool to interpret legislation and water industry jargon when engaging communities (including Indigenous communities).

Stage 2 of BasinGuide provides more detail about how to engage with community and stakeholders.

Initial engagement with stakeholders needs to clearly articulate the issues and opportunities, and make the case for commencing river basin planning. Politicians can play an important role in articulating the need for river basin planning to commence, especially if the need is recognised across the range of political views and roles. Other champions and enablers may be identified who are thought leaders and influencers, but do not have a formal role. For example, academics, practitioners or non-government organisation leaders may be important champions, where their standing and communication abilities enable them to bridge and influence many sides of a conflict or issue.

The fundamental nature of water for human life, food, energy, environment and economy means that there is always competition for water and river basin planning is inevitably political. Building broad support across political groups for river basin planning enables a more productive engagement with communities. Political leaders' support for integrated river basin planning is important for stakeholder engagement, data collection and management, governance, and compliance processes to be prioritised, funded, and actioned.

Stage 3 of BasinGuide provides more detail on the importance of political support for a basin planning process.

2.2.2 Developing a common understanding of plan scope and nested plans

In some contexts, river basin planning may focus almost exclusively on one issue, such as water allocation and sharing between the environment and users, and between users. In other basins, river basin planning can address a broader spectrum of issues including flood and drought management, pollution control, water quality management, flood management and hydropower development. The plan's scope and focus should be decided in the first rounds of engagement. Additional issues can be added to the process as they emerge and are deemed important enough to adjust the scope of the river basin plan.

The concept of 'nested plans' is an important aspect of integrated planning across large and often transboundary river basins. An overall plan that integrates management across boundaries and across various interrelated water resource management issues is central to Integrated Water Resources Management (IWRM). However, in order to accommodate the diversity of issues, cultures, industries, and legal systems, it may be necessary for a number of nested plans to sit alongside and integrate with an overarching basin plan. There are several reasons that nested plans may be necessary:

- There may be subsidiary plans specific to various economic, social or environmental issues, such as water quality, environmental watering, water allocation and irrigation;
- There may need to be specific legal instruments for each national, state or provincial legal jurisdiction; and
- More local or sub-basin plans (integrated with requirements of the river basin plan) can also help support greater local community and stakeholder involvement in setting local objectives and negotiating local agreements to solve issues.

In considering nested plans, there is a need for balance between integration, being holistic and addressing the whole system, versus the practical need for discrete, manageable, governable plans that are focused in content and accountability (and allow for more targeted consultation).

The basin plan itself will be developed and implemented within a broader strategic context. This may include national strategies and may be overarching (economic development for example) or sector based (energy, agriculture, fisheries, environment, or national water resources strategies). They may also be part of a smaller-scale planning process — land and water/catchment management planning processes for example. This guide does not go into detail on this possible broader context. Whilst the basin planning needs to be properly framed in terms of the broader strategies and plans, the methods and process described within this document are focused on the water component only.

2.2.3 Formulating a basin vision

Formulating a vision for the basin involves working with stakeholders to develop a description of the desired future state of the basin, based on a range of environmental, economic, cultural, and social values. The vision describes the long-term future — typically between 20 and 100 years. It is important that it encompass the breadth of values and benefits derived from the water resources within the basin. Focussing on a restricted range of values and benefits (for example, of only one industry) is likely to build up social, cultural, economic and environmental pressures for the future, as the resulting plan will not be flexible enough to accommodate future basin changes and use priorities.

The vision will provide guiding principles and direction to the planning process but is often aspirational, rather than specific. The vision is the foundation of the plan logic and provides the basis for development of specific long- and short-term objectives and planning. Due to its importance in setting the direction of the basin plan, it is important to develop the vision using participatory processes to engage all relevant stakeholders.

Developing objectives, outcomes and targets that align with the vision

Based on the basin vision, develop long-term objectives with stakeholders and the broader community. These long-term objectives translate the basin vision into specific aims for the plan to achieve within a specific timeframe and using the available resources. The objectives are the building blocks that will underlie and shape the basin strategies and ensure they are designed to meet the basin vision. Clear objectives are necessary and agreement on these should be aimed for, recognising that negotiation of objectives with multiple stakeholders will be required in order to achieve the basin vision. Objectives may change and evolve as the basin planning process proceeds.

Frequently, as is the case for many public policy issues, the objectives for a large river basin will embody the diversity and conflicting objectives and values of different groups in society. Since the objectives reflect social values, the highest level of objectives may be difficult to measure. However, from these broader, values-based objectives, more specific and measurable targets will then be developed.
The process of engaging and negotiating with communities, users and stakeholders will help to reveal the interests and needs of all parties. The process of engagement helps to build trust even with those parties whose personal vision may not be fully reflected in the final river basin plan, given that the plan draws together a range of interests and will inevitably involve compromise.

Ensuring that a basin plan's objectives align with the policy and legal capacity (policy levers, legislation, regulation) to achieve the intended outcomes is important. For example, often basin planning frameworks can influence water-related policy levers, yet the political and social expectation is that the plan will influence social and economic outcomes. To achieve these broader outcomes may require consideration of complementary natural resource management measures or other policy instruments in related portfolios or sectors.

The long-term protection of sites of significance should be paramount in planners' and managers' minds. Another key consideration is 'Free, Prior and Informed Consent' of First Nations Peoples (UN, 2007; see case study in Stage 2).

Following identification of a vision and objectives for the basin, the following can be developed:

- Outcomes — the benefits or other long-term changes that are sought from implementing the plan and that will be achieved by meeting the plan's targets. Outcomes are linked with objectives, in that if the outcomes are achieved then the project's objective/s have been met;
- Targets — outcomes that have a measurable benefit and will be used to gauge the success of the plan. The targets will be specific and so can only be finalised once the strategies in the river basin plan have been decided after engagement and negotiation with stakeholders.

Best practice indicates that 'SMART' targets should be identified and adopted. These targets are:

- **Specific** —target a clear and specific area/theme;
- **Measurable** — can be quantitatively assessed;
- **Achievable** — is realistic and attainable within the time period and resources;
- **Relevant** — all (or most) stakeholders must agree on the target; and
- **Time-bound** — specify when the target will be achieved.

The development of a **monitoring, evaluation, reporting and learning** framework is further described in Stage 7 of BasinGuide.

3 Stage 2. Ongoing engagement — Who needs to be involved?

Engaging stakeholders and the community

Key actions

- In consultation with stakeholders, map out all stakeholder groups and develop and implement a stakeholder engagement plan including consideration of Indigenous Peoples and Gender Equality, Disability and Social Inclusion (GEDSI).
- Consider using a formal representative engagement committee where members are required to consult with the stakeholders they are representing.
- Share all of the available information— don't hide things or trust will be lost.
- Seek political leadership and support between all relevant political stakeholders for a basin plan and identify champions.
- Seek to transparently identify and assess the values and objectives of all stakeholders, and engage stakeholders in establishing a basin vision.
- Understand the technical, engagement and communication skills and capabilities of the institutions responsible for basin planning.
- Consider different forms of stakeholder governance — from water user associations, to catchment management groups.
- Establish appropriate engagement with Indigenous Peoples.

Key outcomes

- Trust built between all parties as well as a shared understanding of key issues.
- All relevant stakeholders involved in the planning process, thereby increasing the knowledge base upon which the plan is built.
- Management of risks that arise from inadequate understanding of community needs and water uses.

3.1 Rationale

Government agency policymakers, technicians and scientists are not the only stakeholders in the process of basin planning. Community leaders and organisations need to play a significant role in various parts of initiating, leading, developing, assessing, planning and implementing water management. Well informed and genuine community engagement focused on building trust is needed to involve Indigenous Peoples, water dependent industry stakeholders, the general community including non-government organisations, local government, scientists and other professional disciplines.

In practical terms, stakeholder engagement and consultation help water planners and managers to understand user and community needs and manage these in the most equitable manner possible. If stakeholder engagement is done well and built on a common vision and objectives, it can build the social and political support for a stable planning, regulatory and management framework, as well as support implementation and compliance.

The framework presented in this guide places engagement at the centre of the process, because it must occur early on so that the overall vision of managing a river basin is informed and shared by the community at large. It also needs to occur throughout the process, at each and every step, including monitoring and compliance. Top down, government-led compliance is limited in its reach. With knowledge, support and transparent systems in place, the community can play a strong and important role in ensuring equitable outcomes within a river basin planning system.

3.2 Critical considerations

3.2.1 Integrated water planning — sectors and scales

Water resources need to be understood within the broader context of other related sectors such as natural resources/environmental management; water supply, sanitation and hygiene; finance and economy; agriculture and food; health and wellbeing; transport and infrastructure; and energy and power. If, for example, the basin planning process identifies the need for development of a hydropower dam in the headwaters, this could have livelihood and social impacts for communities and could be linked to security of supply for irrigated agriculture.

Basin planning also needs to integrate across spatial scales. The planning process needs to take into account impacts or benefits at a community/household scale, as well as at the basin scale and any relevant intermediary scales. This is challenging but also one of the key benefits of basin planning. For example, the social, economic and environmental outcomes at the downstream end of the basin are important, but those outcomes are also important for the ecosystems, communities, states/provinces and countries further upstream.

3.2.2 Identifying stakeholders

Every river or groundwater basin will have a slightly different context. Its geography, its ecology, its human uses and its cultural values will be different. Due to these different contexts, the beneficiaries of water allocation, as well as those negatively affected, will vary between basins. For this reason, it is important early in the basin planning process to conduct a systematic process to clearly identify all the stakeholders to understand who will be affected in the river basin planning process (often called ‘stakeholder mapping’).

A useful way to identify stakeholders is to construct conceptual system diagrams of the environmental, social, economic and cultural benefits and impacts from surface water and groundwater flows, extraction, quality and other characteristics. For each of the benefits and impacts, identify which groups of stakeholders are affected (e.g. communities, Indigenous Peoples, farmers, organisations, business, industries, sectors and government).

Case study: Murray-Darling Basin Community Committee

A key mechanism for community and stakeholder input to the development and implementation of the Murray-Darling Basin Plan has been through the Basin Community Committee (BCC). The BCC includes membership from across the Basin, the various water using industries, regional communities, local government and Indigenous Peoples. Establishment of the BCC was embedded in the Australian national *Water Act 2007*, along with other requirements for community consultation at key stages of development and implementation of the Basin Plan. The BCC provides advice to the Murray-Darling Basin Authority (MDBA) concerning community perspectives on implementation of the Basin Plan and other MDBA responsibilities, as well as how the broader community should be engaged. The Murray-Darling Basin Ministerial Council can also seek advice from the BCC.

Basin Community Committee membership as at June 2020 (credit: Murray-Darling Basin Authority)

3.2.3 People, communities and inclusive engagement

Starting stakeholder engagement by listening and developing a common understanding of all stakeholder values helps to develop a wider ownership of the vision and objectives of river basin planning. Engaging stakeholders, especially communities, early can also ensure that all values, uses and objectives are considered, help to guide the technical, policy and planning work, and reduce the risk of negative reaction when plans are released for consultation or at the final stage. Communities are drivers and initiators of the process and not just passive stakeholders. Engagement is required with all stakeholders (including minorities, women, Indigenous and marginalised peoples), with a focus on transparency, genuine consultation and a fair process. Experience in Australia has shown that this is a precondition for the successful development and implementation of a river basin plan.

Stakeholder engagement can take many forms and can vary from low levels of engagement, through to high levels of engagement that give stakeholders decision-making power (Figure 2). It is important that the level of influence that a stakeholder group has on a decision is understood so that expectations are managed, and processes are transparent. For some transboundary basin planning, such as international river basins, it may be that engagement at government level is more prominent in the process than community engagement. Nevertheless, engagement with community providing clarity on the process and considering their perspectives is likely to lead to a more accepted and sustainable plan.

Figure 2. Spectrum of Stakeholder Consultation (Pegram et *al.,* 2013).

A key aspect of enabling and supporting engagement is to build capacity stakeholder and community capacity to participate. This may include a number of approaches. One approach is to build stakeholder and community understanding of the drivers for river basin planning and the technical fundamentals. This could include education and training to build 'water literacy'. Another important part of enabling engagement is to provide access, support and safety for equitable participation, ranging from communication methods that do not assume high levels of education, to use of multiple languages, to provision of childcare at meetings.

Case study: Environmental Water Advisory Groups in New South Wales, Australia

The Australian State of New South Wales (NSW) convenes Environmental Water Advisory Groups in the major valleys of the NSW portion of the Murray-Darling Basin. The groups meet several times a year to consider proposals for environmental flows. The groups include representatives of Aboriginal Peoples, landholders, irrigators, government, water users and independent environmental groups, as well as key government agencies that manage environmental water, operate the river regulating structures and make policy decisions. Involving local representatives in decision making helps the environmental water agencies ensure that flow releases have considered local needs and helps to build local support.

This approach enables everyone to get the same information at the same time in the same forum or meeting. Then decisions can be made at the same time as all stakeholder groups.

Macquarie Cudgegong Environmental Flows Reference Group in the field (credit: T Hosking)

3.2.4 The need for clear communication

When engaging stakeholders, clear communication is essential. Careful, plain language articulation of the problems, issues and priorities is important. Linking to values helps to connect with people's everyday priorities. It is important to recognise that deeply held values often underlie the strong stakeholder positions and strong emotions generated by water allocation and management processes. Recognising commonly held values can often provide a basis to begin planning and negotiation. Those responsible for undertaking basin planning can use language to draw people into conversations, making these concepts accessible and useful, inclusive and outcomes focused. This helps the plan make sense not just to the planners and officers doing the work, but also to the leaders, decision makers and stakeholders more generally.

3.2.5 Gender equality, disability and social inclusion (GEDSI)

Inclusive stakeholder engagement requires ensuring that the needs of the poor and marginalised are understood, and inform river basin planning and associated interventions in order for critical human water needs to be met. It requires that women, Indigenous Peoples, people with disabilities, and marginalised peoples are genuinely involved and that their voices are incorporated into water management decision making. This strengthens the knowledge base, and helps to minimise risks of doing harm to members of the community as a result of inadequate stakeholder engagement processes.

When establishing an enabling environment for river basin planning, it is important to consider existing inequalities and power dynamics to ensure inclusion of all relevant stakeholders. Inclusive approaches have been found to make water governance programs more socially, economically and environmentally sustainable, providing confidence that plans and strategies are more able to contribute to multiple objectives (Grant *et al.*, 2019). The United Nations World Water Assessment Program reported in 2015 that: "No water assessment can be realistic without a gender perspective. And no decision making is inclusive unless both women and men participate in the process" (Seager, 2015, p12).

Why consider Gender Equality?

The Guiding Principles of the 1992 Dublin Statement espouse that: 'Women play a central part in the provision, management and safeguarding of water. This pivotal role of women as providers and users of water and guardians of the living environment has seldom been reflected in institutional arrangements for the development and management of water resources. Acceptance and implementation of this principle requires positive policies to address women's specific needs and to equip and empower women to participate at all levels in water resources programmes, including decision making and implementation, in ways defined by them' (ICWE, 1992). Consideration of GEDSI in river basin planning and IWRM is therefore not a new concept, but has been internationally recognised since at least 1992.

Research across 15 countries showed that water supply projects designed and run with the full participation of women (compared with non- or partial participation) were more socially, economically and environmentally sustainable (Gross *et al.*, 2000). Closing the gender gap — through equal access to assets such as land and water, inputs such as seeds and fertiliser, and training — would increase yields on women-run farms by 20–30 per cent which could reduce the number of hungry people in the world by 12–17 per cent (FAO, 2011; Van Koppen & Kuriakose, 2017a). Involving women and marginalised people in water governance and agriculture programs therefore makes sense for a range of economic, social, and environmental outcomes.

One key issue that serves to exclude women from decision-making forums related to water management is unequal land ownership laws and practices. In many countries, significant disparities exist between men and women in the ownership of agricultural land (Garikipati, 2008). Indeed, the laws or customary practices of 102 countries still deny women the same rights to access land as men (Organisation for Economic Cooperation and Development, 2014).

Inclusive river basin planning requires policymakers and planners to draw on the knowledge and needs of the broader community, including women, many of whom are working in agriculture and have strong connections to water management at a range of levels. Three key principles can support gender equality in river basin planning, as outlined in the box below.

Key messages for Gender Equality in river basin planning

1. Proactive and deliberate meaningful participation of women and gender-discriminated people3 is needed at all stages of river basin planning: Water governance and water, sanitation and hygiene (WASH) issues affect minorities, women and Indigenous Peoples differently, and these differences need to be identified and understood at all stages of the management of a river basin. This includes in hydropower projects, irrigation schemes, dams, diversions, and water sharing arrangements. The best way to address the needs of the community in all planned actions, including legislation, policies and programs, is to support them to participate in decision making so that decisions about water resource management promote inclusion. Taking this message further would also involve going beyond participation to supporting empowerment of such groups, requiring attention to addressing broader gender and social norms and exclusion, since in the long-term sustaining meaningful participation will require such changes. Meaningful participation is required at all stages of the river basin planning cycle.

2. Integration across the SDGs leads to more equitable and sustainable outcomes: The 17 SDGs call for an integrated approach to strategies, policies and implementation at the global and national levels. There is enormous potential in the WASH and water governance targets of SDG 6 (including domestic access to services, transboundary water management, reducing water pollution, increasing water efficiency and restoring water-related ecosystems) to mutually reinforce positive outcomes of gender equality (SDG 5) and reduce inequality overall (SDG 10). Research demonstrates that projects designed and run to be socially inclusive and gender-sensitive are more sustainable. Increasing gender-discriminated people's voices at all levels (global, national, local) can help to achieve these integrated SDG targets, serving multiple goals simultaneously.

3. Good data underpins good practice: Improving data systems of all types underpins good water governance and WASH. Data systems on technical aspects ought not be 'gender blind', and data on gender and social aspects is critical to informing inclusive practice. Sex-disaggregated data can (at a minimum) contribute to gender-inclusive policy formulation. Data on gender inequalities in river basin planning is also critical. For example, research and data collection can uncover barriers to women owning land and accessing finance, which may undermine their ability to participate in water sharing and allocation programs and IWRM (adapted from Grant *et al.*, 2019).

3 Gender-discriminated people are those who are treated unequally based upon their gender. Gender-discriminated people include women, girls, transgender, intersex, and non-gender-defining people.

Why consider disability?

People with disabilities can face social, economic and environmental barriers in accessing water resources as well as ensuring their consideration and involvement in water planning processes. For example, persons with disabilities may experience limited agency in influencing water planning processes which leads to their needs and concerns not being considered in planning. There is typically low or no allocation of financial resources to ensuring that persons with disabilities benefit from water planning processes (World Bank, 2017).

If not considered and engaged in water resource planning, persons with disabilities can be unfairly impacted. Social impacts can include dependency on others for accessing water resources which can result in personal safety issues or uncertainty in ability to access water in public spaces which can limit willingness to engage in community activities. Economic impacts can include the need to pay additional expenses for infrastructure modifications and adapting equipment to enable access to water (including

for WASH, irrigation or disaster management) or exclusion from economic opportunities such as agricultural production due to inaccessibility.

The link between access to water resources and disability is bi-directional, as in many contexts the lack of access to water for basic needs raises the risk of health, occupation, disaster and other risks that can lead to long-term impairments (World Bank, 2017). This link further highlights the need to consider disability in water resources planning.

Approaches for engaging and considering persons with disabilities in water resource planning are wide-ranging. They need to be underpinned by targeted engagement, promotion of persons with disabilities within national, local and community leadership roles, and a clear commitment to disability-inclusive water management at all scales from high level policy to infrastructure changes for improved accessibility (UNDESA, 2018).

Why consider social inclusion including Indigenous Peoples?

Indigenous (First Nations) Peoples across the world hold deep connections to their rivers and groundwater, with knowledge based on thousands of years of experience. Engagement with Indigenous Peoples must be respectful, directed by them, free of coercion, and must provide adequate time for meaningful engagement and consultation. Engagement must provide Indigenous Peoples with the opportunity to provide 'free, prior and informed' consent, before any changes to water use, water bodies, and the ecosystems on which they depend are made. The United Nations (2007) Declaration on the Rights of Indigenous Peoples includes a number of provisions concerning rights to lands, waters and resources that are relevant to river basin planning.

Case study: Aboriginal Peoples' leadership in the Murray-Darling Basin

The Indigenous Peoples of the Murray-Darling Basin[4] are comprised of diverse peoples, of many language groups, who maintain a strong connection to country. The Australian and state governments are increasingly engaging with Aboriginal Peoples in the Murray-Darling Basin to manage water resources and there have been some important achievements. However, important work remains to be done to ensure Aboriginal Peoples have appropriate legal entitlements to water and that cultural heritage, cultural outcomes and connection to Country are recognised in water planning.

Aboriginal Peoples have maintained strong cultural connections to Country (including lands, waterways and seas) for over 50,000 years, despite being oppressed, marginalised and dispossessed of land, water, knowledge and a cultural life. The legacy of the dispossession continues in economic, social and political disadvantage.

Aboriginal Peoples' traditional knowledge has been developed through a varied and complex set of languages, alliances, trading routes, beliefs, social customs, initiation processes, burial rites, and tribal moieties that regulate relationships. These cultural practices involve a deep spiritual understanding of the environment and govern how communities live with and maintain the land, plants and animals of their region. Understanding the land and water through seasonal observations

4 The Indigenous Peoples of Australia as a whole comprise the Aboriginal and Torres Strait Islander Peoples, diverse peoples and cultures covering hundreds of language groups. The Indigenous Peoples of the Murray-Darling Basin comprise diverse groups of Aboriginal Peoples, each with their own language and their own words defining their identity (e.g. Gamilaroi people, Wiradjuri people). For each group, Traditional Owners (elders) speak for Country and maintain connection to Country. First Nations – denoting the original peoples and their political and cultural identity and governance – is a term adopted by some Aboriginal Peoples. The authors seek to be respectful on the choice of terms in the Murray-Darling Basin, Australian and international context.

was once essential to survival and is today important in meeting the contemporary challenges of land and water management, and in continuing to care for Country.

Aboriginal Peoples often view people and Country as interdependent entities that are intrinsically linked in the landscape through cultural and spiritual significance. This means that there is no separation of nature and culture — the health of the natural environment and cultural wellbeing of Aboriginal Peoples is directly influenced by the health of the cultural landscapes, including waterways.

Aboriginal Peoples' traditional ecological knowledge and stories are passed down from generation to generation and continue to this day, supporting a symbiotic relationship with land and water. This knowledge and connection to Country is essential to managing rivers in Australia, and increasingly drawn upon to support decision making about water sharing and management.

As a result of advocacy efforts by Aboriginal Peoples in the Murray-Darling Basin, engagement forums were established, such as the 'Murray-Lower Darling Rivers Indigenous Nations' and the 'Northern Basin Aboriginal Nations'. Through these forums, Aboriginal Peoples have discussed water management issues with Murray-Darling Basin officials and decision makers, informing and influencing decision making relevant to the MDBA and the Basin States. These forums have formal roles in providing advice to the MDBA in assessing water planning and advocating for cultural flows.

More recently, amendments to the *Water Act 2007* have provided a position on the MDBA Board for an Indigenous person. In addition, the MDBA is also now required to report yearly on Indigenous values and uses of water.

While it is important to have meaningful engagement practices and inclusive governance arrangements, a challenge faced in the Murray-Darling Basin is how to match this with improved ownership of water in a system that has been overallocated during the past century. Despite the traditional occupation and ownership of all the lands and waters of the Murray-Darling Basin and beyond, the legal entitlements of Aboriginal Peoples to their water across the Basin remains at just 0.2 per cent of states' licensed allocations (an underrepresentation by population). This situation has historically resulted from the denial of Aboriginal land rights, Native Title and the coupling of water rights with rights to land. However, ironically with the decoupling of land and water rights since 2000, gains in land rights under statutory mechanisms such as the *Aboriginal Land Rights Act 1983* (NSW) and the National Government's *1993 Native Title Act* have not been met with comparable gains in rights to water. As a result, Aboriginal access to water remains inequitable and in addition the economic potential of land rights gains may also be undermined (Hartwig *et al.*, 2020).

Considering how water resources can be redistributed to accommodate for the needs of Aboriginal Peoples is an important part of achieving outcomes for Aboriginal communities and is an issue that continues to be worked through in the Murray-Darling Basin.

Other aspects of social inclusion

In addition to considering Indigenous Peoples, social inclusion requires considering the water benefits, impacts and access issues and opportunities for those experiencing disadvantage due to ethnicity, religion, caste, education, poverty or other reasons. This social disadvantage means that the impacts of water issues and the consequences of planning decisions are likely to have more far-reaching proportional impacts than on those who are more advantaged, and that the knowledge and views of marginalised people is overlooked and/or undervalued. Inclusion in river basin planning engagement is important as part of achieving equity in development, sharing and access to water as well as integrating broader knowledge of the river system (e.g. traditional knowledge).

Safeguarding social inclusion at each step of the process in river basin planning is important, to ensure that people are not further marginalised or disadvantaged in river basin planning, water allocation and sharing decisions. Inclusion means that marginalised people are represented, not only in numbers, but supported so that they can contribute their knowledge equally and influence decisions.

Preparing for trade-offs by transparently identifying values and objectives

At the core of river basin planning is the dependence of many communities and industries on water resources, for multiple objectives. As industrialised development takes place and urbanisation increases, the demand on the water resources increases and the ability to satisfy multiple objectives is challenged. Trade-offs may become necessary – that is, compromises will need to be made. The balance of trade-offs for society is likely to be decided by negotiation underpinned by an understanding of other needs and values, and political decision making.

Whilst these trade-offs are implemented in later stages of basin planning, the initial stages of stakeholder engagement are crucial to transparently identifying and assessing the values and objectives of each stakeholder group, and facilitating ways for different groups and needs to potentially make compromises based on the overarching values set in the vision for the river basin.

4 Stage 3. Governance — Who makes decisions and who is responsible for what?

Enabling governance, policy and legislation

Key actions

- Establish a legislative basis for the basin plan that articulates the roles and responsibilities of relevant organisations, as well as accountability for the development, implementation, monitoring, evaluation and review of the plan.
- Consider separating the basin roles and responsibilities of water resource management, standard setting, service delivery and regulatory enforcement to allow for more effective implementation and transparency of the interaction and trade-offs between these elements of basin management.
- Empower a River Basin Organisation (RBO) or similar entity with oversight and/or authority, allowing it to legally engage with other relevant institutions, such as states/provinces, power and water utilities, agricultural industries, fishery representatives and other water users and the community — necessary for the effective development and implementation of the plan.
- Establish a dispute resolution process.
- Engage Indigenous Peoples interests and knowledge in the decision-making processes.

Key outcomes

- Enabling legislation established.
- Enabling policy and regulatory framework established.
- Institution/s empowered with oversight and/or authority to develop and implement the basin plan.
- Clarity on what can be negotiated with stakeholders, what is not negotiable and where stakeholders are asked for input, but decisions rest with governments.

4.1 Rationale

Governance is defined as referring to all processes of governing, whether undertaken by a government, market or network, whether over a family, tribe, formal or informal organisation or territory, and whether through laws, norms, power of language (Bevir, 2012). In this guide, governance is taken to mean the processes, structures and institutions by which decisions are made concerning water policy and management, and the mechanisms by which decisions are implemented.

A robust and sustainable river basin planning process requires a legislative foundation to either enable existing organisations and/or to establish new organisations to carry out roles and responsibilities related to the development, implementation, monitoring, evaluation and review of the basin plan. The exact form of this legislative basis will vary depending on the system of government and may be primary legislation, subordinate legislation or administrative guidelines. The legislative basis should establish a clear purpose, power and authority for the river basin planning process.

Legislation on its own is not a guarantee of success, but it provides and contributes to the necessary governance architecture and authority needed to progress and implement the plan. Governments and

their agencies play a key role in developing, resourcing, endorsing and implementing a river basin plan. However, governments cannot effectively develop or implement a plan in isolation. Water and related government ministries and departments, as well as community and industry engagement, are critical to the development and implementation of the plan.

4.2 Critical considerations

4.2.1 Build broad political support

Political leadership and agreement should be sought where possible. Successful river basin planning involves major strategic water allocation decisions amongst those who rely on the river. These are difficult decisions to reach agreement on (not every stakeholder can get everything they want) and can be difficult to sustain over time as each stakeholder seeks to gain advantage. When political agreement can be reached on the case for an agreed and stable distribution of water under a river basin plan, a more robust enabling environment results, thus allowing for more efficient development and then implementation of the plan. Sometimes the realistic outcome may not be complete agreement, but rather consensus or compromise with an understanding of reciprocity over time to balance out current losses for future gains.

Political support may include across political parties (where relevant) as well as across sectors (for example, the energy and transport sectors as well as the environment sector), and levels of government (e.g. national, provincial/state and district/local).

How to gain this political agreement will vary depending on the political system in each river basin and each country. Within the dynamics of each political system, the key is to build a network of support among key influencers, with the intention of reaching and maintaining in-principle agreement on trade-offs and the strategic allocation of water. River basin planning is typically transboundary, at either national or sub-national levels, therefore political buy-in at all relevant levels is necessary and requires significant time and resources.

4.2.2 Decisions should be taken at the lowest appropriate level possible

A key principle of IWRM is that decisions should be taken at the lowest appropriate level possible (often referred to as 'subsidiarity'). For example, the decisions on a system limit and system flows for the basin, as well as the major shares of water (see Stage 5) need to be taken at a basin level by a national or international river basin organisation, since it is difficult for institutions at a smaller scale or lower level to take an objective basin-wide perspective. In contrast, once the system limits and major shares have been decided for the basin, the distribution of water to sectoral interests and individual users can be undertaken at a regional, municipal or even irrigation system level. At these lower governance levels, there is no need for the RBO to become involved beyond ensuring sound governance processes are in place, providing the agreed limits and major water share allocations are adhered to, on which the RBO may play a monitoring role.

4.2.3 Role of Government in establishing legislation and institutions

Governments play a key leading, enabling and governance role in river basin planning. In transboundary basins, for a river basin plan to be established, governments must collaborate to reach agreement on principles, institutional arrangements and to reach decisions on strategic allocation of water resources. The governments with the support and involvement of water users and communities must then continue to collaborate to implement, monitor and review river basin planning over time.

In both inter- and intra-jurisdictional basins, governments establish the legislation that will underpin institutional arrangements for river basin planning, as well as the strategic water allocation decisions made and the monitoring, compliance and implementation of those decisions. Funding for establishment of institutional arrangements is also critical, as is adequate funding for all the steps outlined in this guide.

While playing this leading, enabling and institutional role, it is important that governments listen to, engage with and communicate with their communities, industry and other stakeholders. This helps to ensure decisions made take on board all relevant information and perspectives and can be sustained through widespread support. The water resources professionals employed in the relevant government departments have a key role to play in listening to and working with stakeholders, to understand benefits and impacts of river basin planning options and to communicate these to politicians and Ministers.

Case study: Political leadership across political groups

In Australia, water planning, water sharing and water management have frequently been a contentious political issue, as different states, regions and economic groups seek to access a scarce resource. Water markets have been developed and environmental impacts are being addressed by reallocating a targeted amount of water back to the environment, based on an environmentally sustainable level of take. National reforms to water policy, water management and water sharing have been developed since 1994 when an agreement between state and national governments was achieved. Further developments occurred with the National Water Initiative in 2004, the national *Water Act 2007* and development of the Murray-Darling Basin Plan ('the Basin Plan') from 2009–2012, followed by its implementation that continues to date.

For most of this timeframe, the major political parties maintained a common commitment to the intent of the reforms, even when they disagreed over the details. For the Basin Plan, major parties have mostly maintained a bipartisan approach overall. This has helped support industries and communities to adjust and helped negotiation and engagement with communities and industries on difficult questions. Australia's democratic system means there is no guarantee such a bipartisan approach will continue, and increasing water scarcity through drought and changing climate is putting strain on this bipartisanship. However, to date the bipartisan approach to the major principles of water reform and river basin planning has helped to support significant adjustments to the sharing of water between industry and environment, as well as to embed an adaptive river basin planning approach. Nevertheless, participation of all states and territories remains conditional and is continually being renegotiated through challenges that could be linked to climate change such as increasing incidents of drought, floods, and fires.

4.2.4 Enabling environment for river basin planning

A clear governance and decision-making framework backed up by legislation and policy as well as empowered institutions, provide an enabling environment for development of a basin plan. In parallel, successful governance requires a level of engagement in and acceptance of decisions by those affected, including all levels of government, stakeholders and communities.

If communities are not ready/willing to engage then it will be very difficult to implement any plan effectively. Developing ownership of both the challenges and solutions is critical.

Governance is manifested in the enabling environment for river basin planning (Figure 3) which is the legal, organisational, fiscal, informational, political and cultural context within which a basin plan is developed and implemented.

Whilst an enabling environment provides the basis for development of a basin plan, getting the perfect enabling environment is not a prerequisite to start plan development. Often the important thing is just to make a start and progress elements of the enabling environment (including stakeholder buy-in) in parallel. In balance with this, it may not be effective to get too far ahead with one element if other key elements are taking more time. For example, securing a critical mass of political and community support may be required before implementing legislation or establishing an RBO.

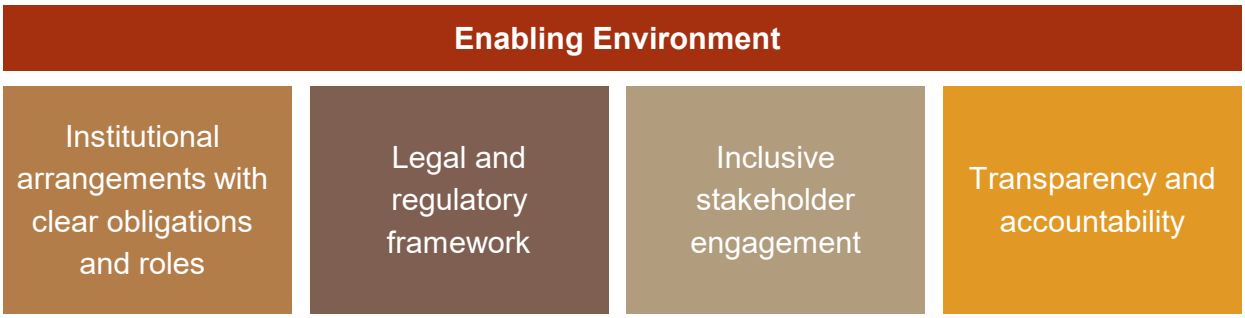


Figure 3. Enabling environment for river basin planning

Legal and regulatory framework

For basin planning to succeed it needs to be supported by a strong and accountable policy and legislative framework. The exact legislation and policies needed to develop an enabling framework will differ between countries and even states/provinces within countries, but they generally include a national water policy supported by state policies and an act or law outlining the basin planning process and empowering the relevant agencies.

To assist in basin planning, the policy and legislative enabling environment needs to: i) clarify the purpose of basin planning; ii) define the basin planning process; iii) empower RBOs; iv) mandate stakeholder engagement; v) establish mechanisms and instruments for implementation and dispute resolution; vi) identify the scales of the planning processes (e.g. basin, sub-catchment); and vii) indicate sources of funding for developing and implementing the plan.

The exact form of this legislative basis will vary depending on the system of government and may be primary legislation, subordinate legislation or administrative guidelines. The legislative basis should establish a clear purpose, power and authority for the river basin planning process.

Other legislative and regulatory reforms may also be needed to support basin planning. For example, in Australia, a critical step was the establishment of entitlements to water that had similar properties to land titles, in that they were explicit, exclusive, tradeable and enforceable (Doolan, 2016).

Institutional arrangements with clear obligations and roles

Many different types of institutions can take part in river basin planning. They include large transboundary or international entities, national, state and local governments, environmental organisations, private sector water users (e.g. irrigator associations), and civil society groups and community organisations. In this guide, 'institutional arrangements' refer to the responsibilities, modes of operation and legal status of these various entities, and how they relate to one another.

Clear obligations/responsibilities for each institution that are defined by the appropriate legislative and executive powers are required. This supports not only efficient operation (by reducing duplication, overlaps and gaps), but also enables each institution and its staff to act rigorously in pursuit of their role. Without genuine recognition and backing of their legal status, institutions cannot properly undertake the function for which they have been established.

Organisations with the management and technical capacity to effect change are essential if a river basin plan is to be developed and implemented. The most effective approach is to have a single mandated lead institution. This is often a River Basin Organisation or, depending on the scale, a similar entity such as a catchment management committee or water user group. As they are a very specific institution for river basin planning, RBOs are discussed in further detail below.

Case study: Water legislation

At the national level, Australia has the *Water Act 2007* (the 'Act') , which establishes the Murray-Darling Basin Authority to develop a Basin Plan for which the Act establishes the minimum requirements, establishes the Commonwealth Environmental Water Holder, and establishes the role of the Bureau of Meteorology in collecting and publishing water information at the national level. The Murray-Darling Basin Plan establishes a 'sustainable diversion limit' (extraction limit) for the basin and requirements for state water plans to implement, inter alia, the limit.

Australian States have their own water legislation — most of which predates the national legislation — because the States have the responsibility for water management. Most States' legislation establishes statutory water plans at the valley or aquifer scale. These plans establish the available water resources, the objectives at the local scale, water allocation shares for the environment, the sustainable diversion limit, and the shares and access rules between different types of water access, including for irrigation. The valley or aquifer plans allow for more local development and stakeholder input and are then submitted to the MDBA and the National Water Minister for assessment and accreditation against Basin Plan requirements. The Basin Plan and State plans are reviewed at 10-year intervals.

Inclusive stakeholder engagement

Governance in a river basin is often complex. While each management institution in a basin plays an important role, the array of decision-making bodies can make it difficult to communicate clearly and transparently to the public on water management matters. Continual collaboration with basin partners is needed to help to communicate shared messages and build better understanding of the issues.

Inclusive stakeholder engagement with water users and the broader community is therefore essential for any river basin plan to have effect. If stakeholder engagement is done well, it can build the social support for a stable planning, regulatory and management framework, as well as support implementation and compliance. It also helps build and maintain stable political support for the planning process. Indigenous engagement must be meaningful and this needs to be reaffirmed throughout the river basin planning process. Inclusive stakeholder engagement is discussed in Stage 2.

Transparency and accountability

Transparency and accountability in relation to policy development, water sharing, water allocation and financial decisions is necessary for water users and the general community to have confidence in the proposed river basin planning arrangements. Clear and published information about the rationale for decisions, who makes them and how often they will be reviewed, provides stability and security for water users, and this encourages them to support basin planning initiatives. Publication and transparency of the information base and modelling that is used as the basis for decisions is also a critical part of the institutional arrangements.

Another aspect of establishing transparent and accountable institutional arrangements is to consider separating the roles of water resource management, standard setting, service delivery and regulatory enforcement into different organisations with separate decision making and accountability. Separating these roles provides a means for governments and communities to understand and make transparent the trade-offs between these elements. It also ensures that the water sector is subject to independent regulation on environmental and health issues.

4.2.5 River basin organisations

An RBO in this guide is any organisation established to develop and guide implementation of a basin plan, regardless of its regulatory powers and level of political commitment. An RBO needs to be empowered with recognised oversight and/or authority (legislative powers), allowing it to legally engage with other relevant institutions, such as state government ministries and sector departments, power and water utilities, agricultural industries, fishery representatives and other water users and the community (Schmeier, 2015). RBO access to sectoral information, and mechanisms to ensure collaboration, are critical.

An RBO can take many forms with varying degrees of legislative power:

- A **Basin Commission** has the power to convene stakeholders but not to enforce a basin plan. Examples include the Mekong River Commission in South-East Asia and the Lake Chad Basin Commission in northern Africa. In Australia, this model has been used for the River Murray since 1914 and was used for the Murray-Darling Basin until 2008.
- A **Basin Authority** generally has regulatory power to develop, guide implementation and enforce a basin plan. An example is the MDBA in Australia, since 2008. Its regulatory powers are constrained by Australian constitutional arrangements between the National and State Governments. However, it is empowered to monitor implementation and compliance, and for enforcement in certain circumstances.
- A **Basin committee or board** may be responsible for the administration, regulation, maintenance and operation of projects.

Regulatory powers are often needed for the RBO to develop and implement a basin plan (Pegram *et al.*, 2013). The regulatory powers required by an RBO will be context-specific — ranging from an agreement between parties, with regular auditing and oversight, through to legislation and regulatory compliance and enforcement (GWP & INBO, 2009). The success of any regulatory framework will depend on the standard principles of best practice regulation. Success will also require community and political support, but with regulatory distance from politics, as well as the skilful use of a range of regulatory tools.

A range of potential functions for an RBO is summarised in Table 1. The extent to which an RBO is responsible for some or all of these will depend on their mandate and legislative powers.

Table 1. Key functions of a river basin organisation

Function	Description
Planning	Formulate a river basin plan for the medium- and long-term management and development of water resources.
Decision-making mechanisms	Providing principles, process, framework and/or secretariat to facilitate decision making on the river basin plan and its implementation.
Stakeholder engagement	Providing principles, process, framework and/or secretariat to facilitate community and stakeholder engagement in the river basin plan and its implementation.

Function	Description
Constructing, operating and maintaining infrastructure	Develop and maintain the infrastructure needed to regulate, operate and deliver water along multi-jurisdictional rivers, according to the basin plan.
Allocating water	Apportion water to different sectors and geographic areas. This includes catering for the needs of rivers and groundwater systems.
Distributing water	Ensure that the allocated water reaches its point of use.
Resolving/managing conflict	Enable and promote negotiation and resolution between basin stakeholders.
Monitoring and investigating, data and information-sharing	Collect the information needed to assess and inform river basin planning, including the sharing of data with and between jurisdictions.

The investment (funding) context will also influence the roles and responsibilities of an RBO. Adequate financial resources will be required for it to:

- conduct thorough and genuine stakeholder engagement;
- develop the plan and adaptively manage it;
- collect, audit and respond to monitoring data;
- audit compliance and implement enforcement where within powers; and
- resolve/manage conflict effectively if or when it arises.

Case study: River Basin Organisations

One way to characterise the "commission" and "authority" models is by differentiating them into a "round table" (or consensus) approach or a "regulatory" approach.

In the Murray-Darling Basin, a consensus-based round table approach was used from 1914 to 2007 through the River Murray Commission (1914–1992) and then the Murray-Darling Basin Commission (1992–2007). The approach still continues for some programs.

A legislative and regulatory approach was introduced in 2007 to create the MDBA and, in 2012, the Basin Plan. This approach gave the MDBA certain powers, while recognising that the States still hold the lead role in most areas of water management. The two models now operate in parallel, but with clearly defined and separated mandates for each.

Elsewhere in Australia, the consensus-based approach is used, for example in the Lake Eyre Basin and for a large cross-border groundwater system in the Great Artesian Basin.

4.2.6 Establishing transboundary dialogue

Establishing appropriate institutional arrangements that support transparency and accountability includes beginning transboundary dialogue and developing agreements on the process and creating a forum for discussing issues and resolving possible trade-off disputes.

The exact pathway for establishing dialogue will vary. In some river basins there may already be a suitable forum, platform or interstate (or international) process for such discussions. In some basins, initiation of transboundary dialogue may require political support and sponsorship (for example an initial meeting and declaration of Ministers that discussion and development of the plan should begin). Development of the river basin plan will ultimately require some kind of formal governance and process to clarify who

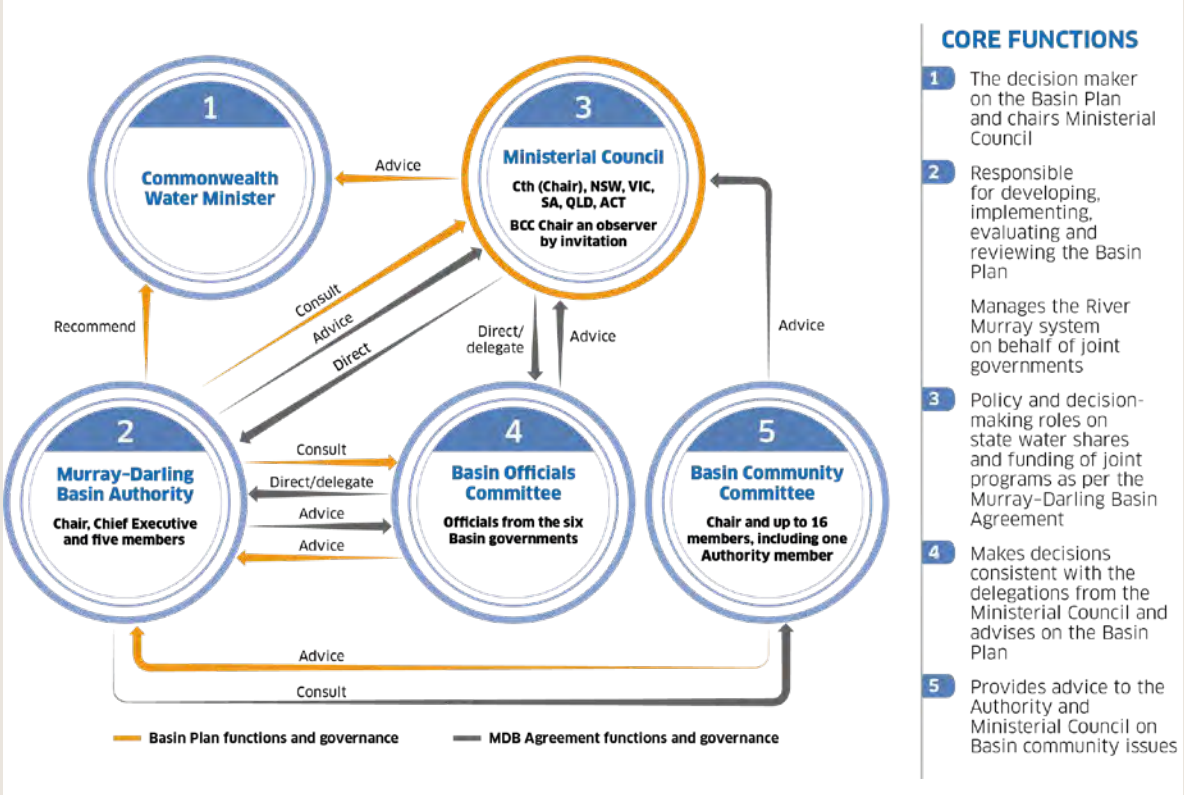
can make decisions on behalf of each jurisdiction and how joint decisions are made. However, it is also important that in parallel or between formal meetings, state officers can meet to work out technical issues or to gather input from stakeholders and experts.

Case study: Decision-making structures in the Murray-Darling Basin

In Australia, the shared water resources of the Murray-Darling Basin are administered under state legislation and through a range of formal committees, working groups, an Authority and a Ministerial Council. Key bodies include the Ministerial Council (including water ministers from the national, basin state and territory governments), the MDBA (which reports to the National Minister), the Basin Officials Committee (which implements the decision of, and provides advice to, the Ministerial Council), and the Basin Community Committee (which provides advice to the Ministers and the MDBA). MDBA also provides technical support and advice to a range of other Basin Plan committees and working groups.

Officials of the national and state water agencies and the MDBA will also meet frequently to work through detailed technical, policy and project planning issues, without taking formal decisions. These less formal discussions provide the basis for briefings to the formal committees, Authority and Council.

In addition, MDBA's Advisory Committee on Social, Economic and Environmental Sciences plays an important role in providing up-to-date scientific advice to the MDBA on its policies and programs. Basin planning works at the science-policy interface and maintaining connections with the research community is an important part of ensuring decisions are made based on the best available scientific knowledge and evidence.



MDBA Governance Chart. The five Basin states lead local and regional water management and have their own governance, legislation and decision-making (credit: Murray-Darling Basin Authority)

4.2.7 Dispute resolution

Disputes over water resources are common within a transboundary basin context, and therefore sound dispute resolution mechanisms are needed within the governance framework of a river basin planning process.

Dispute resolution processes will vary across RBOs, but need to ensure the timely resolution of conflicts and guarantee member states' commitment to complying with decisions taken in this context (Schulz & Schmeier, 2012). External conflict management institutions — such as regional or international courts or tribunals that are considered independent and impartial to the conflicting parties — may offer effective ways to manage disputes.

Culturally appropriate methods will be needed when working on disputes with Indigenous interest individuals, communities and groups.

Case study: Dispute resolution in the Murray-Darling Basin

In Australia, the Murray-Darling Basin Ministerial Council provides a forum to negotiate disputes. In the mid-2000s, a major drought led to pressure for the National Government to act, resulting in the *Water Act 2007* and the Basin Plan. These mechanisms established national forums for the state and national governments to play a key role in reaching agreements (e.g. Council of Australian Governments, Ministerial Councils, Basin Officials Committee and various working groups).

The dispute resolution mechanism in the Murray-Darling Basin Agreement between the States allowed for an independent arbiter to be appointed by the Chief Justice of the Supreme Court in Tasmania — an Australian State that is outside the Basin and therefore independent.

More recently, the MDBA moved to engaging through their regional staff network and a range of committees (e.g. Basin Officials Committee, Basin Community Committee) to resolve issues that arise between stakeholders, communities and the MDBA (MDBA, 2015).

5 Stage 4. Situation assessment — Where are we now?

Assessing current status and trends in surface and groundwater

Key actions

- Collect social, technological, environmental, economic, policy and legal data and information for the basin.
- Determine current and future system needs as well as extractive use needs (surface water and groundwater).
- Determine the current and future availability of water.
- Developing models using best available science and knowledge can provide information for decisions and trade-offs in the next stage, but availability of models is not critical to get started, or for simpler systems.
- Engage communities in building a common understanding of the basin, including identifying issues of common concern.
- Develop a process to assess the level of confidence associated with each data set.
- Develop a single source of truth that all agree is the baseline — acknowledge where its weaknesses are.
- Compile information into a situation, or state of the basin, assessment.

Key outcomes

- Agreed foundation information and understanding of the basin established in a situation, or state of the basin, report.
- Process established to actively engage and involve, as well as make information available to, all stakeholders.
- Developed the basis for hydrological and other computer models that can later be used to assist river basin plan decision making.
- Present and future water supply and demands quantified.
- Issues of common concern identified.

5.1 Rationale

Understanding the basin context from a biophysical, social, political, economic, environmental and cultural perspective is vital to the basin planning process. This context provides a status quo or situation assessment that informs planning, and can be linked to monitoring to support decision making and adaptive management. The situation assessment at the start of basin planning will form an important "baseline" to underpin implementation, monitoring, evaluation, reporting, learning and review of the plan over time. For this reason, the information and data collected needs to be relevant to the objectives, strategies and actions of the plan. The situation assessment can be presented in a 'state of the basin' report.

5.2 Critical considerations

5.2.1 Key components of a situation assessment

It is important that basin planning is informed by a 'situation assessment' or 'state of the basin' report, telling us "where are we now?".

The situation assessment first needs to define the water resources to be subject to the river basin assessment and plan. Once the water resources to be included in the plan are defined, four key actions can be undertaken to inform the situation assessment (Pegram *et al.*, 2013):

1. **Setting and context** — Include a qualitative and quantitative description of the major biophysical and socioeconomic processes of the basin. This may include geological origin and formation of the basin; hydroclimate processes such a monsoon and cyclone systems; cycling of sediment, carbon and nutrients; delta formation; and human settlement and migration. Critical to this is a description of the hydrology and hydrogeology of the basin.
2. **Status and trends** — Understand the hydrometeorological, ecological, social, sectoral (e.g. agriculture, forestry, fisheries, mining, industry, tourism) and socioeconomic status and trends in the basin. Assessment of hydrology and hydrogeology as well as water use is fundamental here and will require information from all sources outlined above. A useful framework for establishing status and trends is STEEPL (Social, Technological, Environment, Economic, Policy and Legal — described further below).
3. **Making values explicit** — Consider all the values for the river basin water resources, held by different stakeholders. The identification and discussion of values will also be a key part of the stakeholder and community engagement stage, which will link to the situation assessment. Economic values will likely include more than just extraction for agriculture, but may also include fisheries, power and domestic and urban water supply. The river will also likely provide ecosystem services, such as water quality and sediment distribution. Environmental values dependent on the river will include a range of animals, plants and ecosystem functions. In addition, for many communities, rivers and other water resources provide cultural and/or spiritual benefits. It is important to have all values made explicit so that the planning process can work out ways to talk about them, negotiate trade-offs and consider a range of outcomes together. Each decision on allocating water is likely to have benefits and impacts on a range of values and thus stakeholders. A key part of making values explicit is the building of knowledge, understanding and integration of Indigenous cultural values, knowledge and perspectives into river basin planning.
4. **Identifying issues** — Identify critical planning issues facing basin planners and communities, as well as aspirations and development objectives. Document the issues of common concern to stakeholders. It is also important at this stage to identify all the users dependent on the water resources, including those users not extracting water, such as fisheries, hydropower, cultural, transport/navigation and recreational users. Identifying issues will also be a key part of the stakeholder and community engagement stage, which will link to the situation assessment
5. **Early identification of the implications and impacts of changes on particular groups of water users** — The situation assessment should create the baseline information from which impacts of changes can be assessed and decisions made. This task of assessing impacts and benefits of changes (often using hydrological and economic modelling, as well as other tools) will build on the situation assessment and continue the assessment to assist the planning and decision making (Stage 5). Change evaluation should also continue as part of monitoring, evaluation, research and learning (stage 7).

A common framework for situation assessment

A common framework used for establishing status and trends for a situation assessment is called STEEPL (Social, Technological, Environment, Economic, Policy and Legal).[5]

The **Social** context and the social benefits from water resources are an important consideration. Which communities are dependent on the volumes, flows, quality and groundwater levels of the water resources? Within the communities, which social groups are most dependent and likely to feel the impacts of water resources issues covered by the river basin plan? What are the social and cultural values and traditional knowledge important to Indigenous Peoples in the river basin? Consideration of this information in the situation analysis is a key part of ensuring an inclusive approach is taken from the start.

Technology status, accessibility and technological developments can have benefits and impacts on availability and distribution of water resources. The situation assessment can provide a snapshot of the status of relevant technologies and the likely future uptake of technology, which can be a driver for change in patterns of water use and mitigation of impacts of use. The situation assessment needs to consider the best available scientific knowledge (and gaps in that knowledge).

Environmental information is a key part of the situation assessment, providing a baseline of whether environmental water requirements are being met for ecosystems and for human uses, as well as the trends and predictions of key environmental indicators, including hydrological, hydrogeological, physicochemical and ecological indicators. This will inform negotiation and decisions about the river (or aquifer) system needs and the setting of an extraction limit to balance amongst environmental and various human needs. Assessment of interdependency between surface and groundwater is one key element.

Economic assessment needs to include all parts of the economy that benefit from, or are impacted by, the water resources. Agriculture will be a key component, but other industries dependent on water resources are likely to include power, navigation, urban water supply and related industries, fisheries and mining. Economic assessment can also extend to methods to value the ecosystem services provided to humans by water resources including, for example, water treatment and increased fertility of floodplain agriculture.

The situation assessment also provides an opportunity to document the baseline **Policy** and **Legal** context. Documentation will include the existing governance, legislation, regulatory and compliance status. This is the context in which river basin planning will take place and will also include enabling legislation and policy. The decisions made on the content of the river basin plan may then change some of the legal and policy context.

Data for situation assessment

Situational assessments usually need considerable data input. This can come from a range of sources, including:

- Geographic Information Systems (e.g. land use information, remote sensing of vegetation);
- Administrative/geopolitical records (e.g. agricultural productivity, population census);
- Measured records (e.g. rainfall, temperature, stream flow);
- Modelling and forecasting (e.g. for assessing areas where data may be poor or patchy); and
- Basin stakeholders such as Indigenous traditional knowledge, local communities, industry associations, and NGOs.

5 There are a range of frameworks that can be used. For example, another very common framework is DPSIR — Drivers, Pressures, State, Impact and Reponses — used in many state of environment, state of river, and state of basin reports.

Whilst collection of data, information and modelling is important, it is essential to have a clear objective and process in place for analysing and using the information and results produced, as well as making it available for basin planners and other stakeholders. Equally, comprehensive availability of data, information and modelling is not critical to get started, or for simpler systems.

Another important consideration to establish at this stage of the process is integration and exchange of data between jurisdictions, government agencies and other parties — see BoM (2017) for a description of good practice for water data management. Without such integration and exchange of data, development and implementation of the plan will be hindered.

Identifying issues of common concern

Identifying issues of "common concern" is a key outcome of the situation assessment. Once a basin description has been developed with the involvement of communities, water users and water managers, it is necessary to identify the key issues of common concern experienced by river basin stakeholders. These typically fit within water quantity (supply-demand); water quality; and environmental, cultural and flood management areas. Food security may also be an important issue, such as through irrigated agriculture or through fisheries that support riverside villages. Identifying issues of common concern will serve to draw key stakeholders together around areas of mutual interest and priority needs.

Once the issues are broadly defined, studies will be required to obtain a better understanding of these issues of common concern and to then identify options for managing them. Studies may include population and water demand projections, bulk supply and distribution, and key sources of water pollution. Many of the issues of common concern will also be drivers for river basin planning, building impetus for the planning process.

Engaging communities in building a common understanding of the basin

It is critical to engage communities and other stakeholders in building a common understanding of the state of the basin, as well as in decision making and trade-offs. To enable engagement, there needs to be a "joint discovery" of basin information and management ideas, with community and stakeholders. It is often best not to present stakeholders with all the data and modelling predetermined, but that a joint analysis process whereby bureaucrats, community and industry undertake a process of discovery together, helps to ensure that stakeholders are engaged and have trust in the results.

Consider the human dimensions of presenting and using information, data and modelling. It is important to communicate modelling outcomes to tell a story. In doing so, it is critical to be honest and transparent about the assumptions and uncertainties in the models and data. Models inform the debate and are important as inputs to decision making, however, do not provide solutions or make the decision. Modelling results should not be regarded as an end in itself.

Reports are not always the best way to communicate. Rather, a range of methods need to be employed to communicate resource assessment — including tangible and practical guides — in a way that is relevant and engaging for the target audiences. Providing communication products for river basin planning in relevant languages will assist in the meaningful engagement for Indigenous interest groups.

Data that drives gender equality, disability and social inclusion

Water users and managers are not all the same, and are made up of women, men, children, people with disabilities, people from different ethnic backgrounds, Indigenous Peoples, youth, the elderly and other groups. All these water users have different water needs and responsibilities with respect to water management. This can be better understood through quantitative and qualitative data collection and analysis.

Data can be a tool for empowerment, but it can also hide disparities when data is not disaggregated, or parts of the population and their water needs and knowledge are excluded. Disaggregated data (by gender, disability status and other groups) is therefore required to understand how water management decisions affect men, women, boys and girls differently. For example, women's access to and ownership of land has strong links to water rights and access to water. This is a data gap that needs to be filled in order to understand how various water management strategies may affect men and women differently.

It is also critical to collect and analyse qualitative data on lessons learned in efforts to increase Indigenous engagement, gender equality and disability inclusion in river basin planning, in order to inform evidence-based practice.

Using risk management approaches to support a situation assessment

Assessments for basin planning commonly occur in the context of uncertainty. Risk management approaches can be used to understand uncertainty and risk and incorporate them into a situation assessment.

The international standard on risk management (ISO 31000) defines risk as "the effect of uncertainty upon objectives". A thorough and robust risk assessment process will help to map the key risks to people and environments within a river basin and help identify which ones should be prioritised (e.g. high likelihood and catastrophic consequences). Using the International Standards process, a multidisciplinary group of experts identifies hazards, assesses the likelihood of the hazard occurring, assesses the consequence, then uses likelihood and consequence to rate risks as high, medium or low. This information can inform the identification of issues of common concern for inclusion in a situation assessment.

The use of water resources modelling

Models are useful but not essential

Water resource models are a set of tools that can support river basin planning and operation. They provide information that water planners/managers use to understand the basin and provide support to planning and decision processes. They should never be considered as the only tools, or the only "correct" answer.

Whilst they are useful tools, models are not essential to river basin planning. In some contexts, the development of a model/s may not be possible due to financial, hydrological complexity or timing constraints. In addition, for simpler and smaller scale systems, development of a complex model may not be necessary or justified. In this case the collection of historical information and data, and its analysis, can provide water balance and water accounting information as well as important contextual insights that guide decision making.

Roles that models play in river basin planning

Ensuring that models have a proper place in the process is essential, as is an understanding of their performance and limitations, so that river managers know how best to use the information that they provide.

There are three key roles for water resource models and data in river basin planning. The first is in informing the understanding of the state of the basin (or situation assessment) through providing a scientific basis for understanding of the historical and current condition of the basin (e.g. flow regime, agricultural production, impacts of existing infrastructure).

The second is in enabling running of scenarios of possible future plans to inform the development of policies and strategies. This is covered further in Stage 5.

The third role of water resource models can be in assisting with system operations. These are usually run in real time so that decisions regarding infrastructure changes (such as opening or closing storage regulators, timing of pumping or access restrictions) are informed by simulating those decisions to evaluate system impacts. They can also be used to develop operational rules or controls based on real time data thresholds so that upstream and downstream conditions are understood when changes to river operations are required.

Models do not make decisions, people do

There are many tools and platforms available for water resources data and modelling, ranging in levels of sophistication, but the key consideration is how these tools are applied as an input to decision making. Decision making should draw on the best available science and other sources of knowledge but cannot, and does not, need to wait for perfect information. Science on its own will not deliver "the answer", because many river basin planning decisions are social questions and processes that require community and stakeholder engagement and negotiated solutions (informed by science and other knowledge). In engaging stakeholders in decision making based on modelling, be clear and frank around the assumptions adopted. It is important to ensure that capacity development runs parallel to the implementation of any technology to iteratively build up the sophistication of the tool to align with the capacity of the operators and the stakeholders. Using the same modelling principles to include delivery of cultural water and cultural outcomes would enhance outcomes beneficial to all stakeholder groups.

Model development and application

The development of situation assessments, planning and operational models can be onerous and challenging. River systems are inherently complex, and while computing power and software development is always providing more capabilities, ultimately the performance of any model will be limited by financial and human resources available for their development. Given the potential complexity in developing models for basin planning, it is useful to simplify to ten iterative model development steps as shown in Figure 4 (Jakeman *et al.*, 2006).

Engaging stakeholders to ground truth models based on their local knowledge will build trust and confidence, otherwise models may be viewed with scepticism.

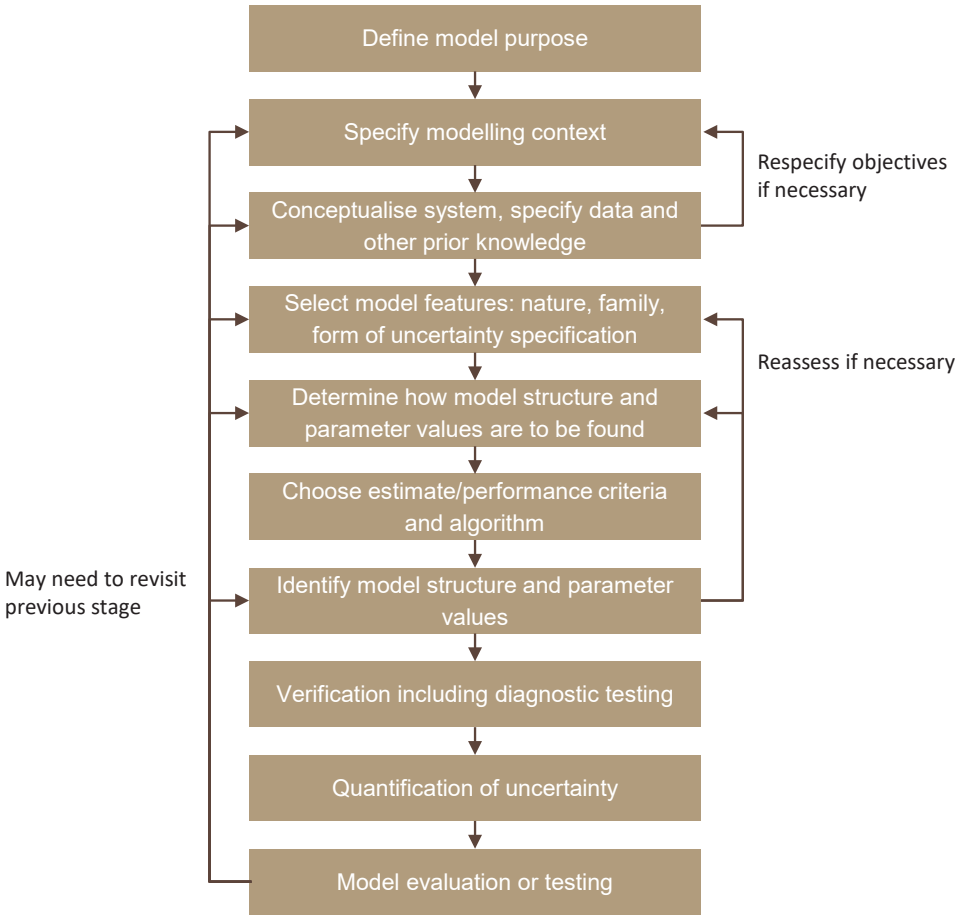


Figure 4. Ten iterative steps in model development (Jakeman *et al.*, 2006)

Assessing future climate scenarios to inform planning decisions

Impacts from climate change are likely to arise as a key threat to water quantity, quality and flood management. Consideration (and modelling) of potential climate change scenarios may be necessary to inform water resources management at the basin level.

In this guide we differentiate between climate variability (changes that occur over smaller timeframes, such as a month, a season or a year) and climate change (changes that occur over a longer period of time, typically decades or longer). A basin plan needs to take both climate variability and climate change into account as it informs understanding of how much water is likely to be available within the system at different times.

Consideration of past climate variability and climate change

For consideration of past climate variability, assessment of river basin climate, inflows, evaporation, seepage and 'losses' to groundwater is often based on historical records which may stretch back between 20 to 140 years.

However, more recent historical experiences and assumptions based on measured data may not take account of the full range of past climate variability and climate change. Water management and allocation based solely on measured data and recent experience can be found wanting when, for example, a drought occurs beyond the drought intensity of the data record, or assumed seasonal phenomena, such as rainfall or monsoons, do not occur or not to the degree that may be assumed based on measured data.

The recent historical experience is only a "snapshot" of the climatic variability and climate change that may have occurred over the previous centuries or millennia. Paleoclimatology is the study of climates for which direct measurements were not taken. Sources of information for understanding past climate are elements of the landscape that record a 'memory' of the paleoclimate stretching back a thousand years or more such as cores, sediments, tree rings, cave stalactites and stalagmites. Indigenous historical knowledge can help to include climate variations that are beyond the comparatively short duration of monitored records. Interpretations of the climate history provided by these studies can be further extended by statistical methods to produce data on climate sequences going back tens of thousands of years.

Prediction of future changes in climate

Predicting future changes in climate is also an important part of the situation assessment. Climate change is leading to meteorological and hydrological conditions that exceed the boundaries of previous climate variability. It is important therefore, that the situation assessment considers alternative future climate scenarios. These may include droughts of increased duration, frequency or severity and/or floods of greater extent, duration and severity than previously experienced, as well as consequences of seasonal rainfall failure and events such as severe wildfires. Climate scenario assessments for basin planning generally draw on sets of climate projections made available through the Intergovernmental Panel on Climate Change and by national or regional science centres.

Informing decision making

The assessment of climate scenarios should feed into decisions on how the river basin plan will allocate and manage water under changing average conditions as well as changing extreme climate events and what data threshold conditions will trigger planning for droughts and floods. Planning and decision making are further considered in Stage 5 of this guide, while climate change will also be an important consideration in evaluation and review of a river basin plan in Stage 7 of this guide.

Assessing groundwater and connection to surface water

In some cases, the groundwater (hydrogeological) basin boundaries will coincide with surface water (hydrological) basin boundaries, while in others they may not match. In either case, consideration is needed of the connection between surface and groundwater. Assessment of groundwater resources needs to consider the groundwater resource units (aquifers or other management units), recharge, inflows, storage and outflows, extraction demand, connectivity to surface water, as well as suitability for end use in terms of water quality. Where detailed data is not available, useful system models can still be developed by applying reasonable assumptions on recharge and storage, based on landscape factors, soils and geology. Assumptions can also be developed about likely extraction per person or per hectare, where data is not available.

Groundwater resources include alluvial sediments associated with rivers, aeolian sand aquifers (often coastal but also desert and arid systems), porous rocks (such as sandstone and limestone) and fractured rocks (such as basalt and granite). Some aquifers will be artesian, meaning the water is stored under pressure and so when released does not require pumping from the bore or well. Each aquifer will have variable capacity to store and transmit water. These varied characteristics will present themselves in varied impacts to groundwater from human activity, as well as varied benefits in terms of quantity and quality of water that can be extracted.

One key issue is whether extraction exceeds recharge and other inflows. If this is the case, the resource will eventually become exhausted and a decision must be made on whether to allow this to occur or whether to restrict extraction to more sustainable levels.

In some groundwater systems, another key issue is the suitability of the water for the end use. Some groundwater systems naturally contain high levels of pollutants that are a risk to human or animal health, while some systems become contaminated from pollution. In other cases, salinity or sodicity issues may limit the suitability for human and animal consumption and/or irrigation of crops.

It is also important to understand the connection of groundwater to surface water. Rivers and streams may naturally gain or lose water from or to groundwater. High levels of extraction of groundwater in connected systems can lead to depletion of river flows, especially in dry conditions. Where identified, these conditions will require integrated management in the river basin plan.

Case study: Groundwater and surface water connectivity in New South Wales

Studies have found a high level of connectivity of groundwater and surface water in many valleys in the Australian State of New South Wales (NSW). In some rivers, water resources managers found that when conditions were dry and river levels low, pumping from the adjoining alluvial aquifers could result in reducing river flows or even pumping the river dry. As result, many NSW Water Sharing Plans include rules that: i) require new groundwater bores to be a minimum distance away from rivers; and ii) link seasonal water allocations of groundwater licences to surface water allocations in the adjoining regulated river. This means that in dryer conditions groundwater pumpers can only take a smaller proportion of their total long-term entitlement volume. For the Hunter River valley, studies showed that mines were impacting river baseflow by intercepting aquifers, drawing down water tables and impeding the interception of surface water runoff. This would potentially impact on flow delivery along the regulated river, while elsewhere impacting the number of days flows were above pumping thresholds (NSW Department of Industry, 2018).

Peel River, New South Wales, Australia (credit: D. Winfield)

6 Stage 5. Plan — How do we plan, consider options and decide strategies?

Considering strategies, options, negotiating trade-offs and making decisions

Key actions

- Determine the content and timespan of the basin plan.
- Identify strategies (and alternative options for those strategies) that could contribute to achieving the basin objectives and vision.
- Evaluate options against clear and agreed technical, financial, social, ecological, economic and institutional criteria linked to the objectives.
- Evaluate the options using a range of sources of information to assess option effectiveness against the objectives, including scientific data, hydrological and other modelling, quantitative and qualitative information stakeholder engagement, scientific, local and traditional knowledge.
- Evaluation of options can use decision support techniques such as multicriteria analysis (MCA), economic cost-benefit or cost-effectiveness analysis, and risk assessment.
- Negotiate trade-offs between different water uses, informed by the evaluation information and decision support techniques.
- Develop mechanisms to offset or minimise the negative impacts on basin stakeholders.
- Decide on the combination of strategies which is likely to best achieve the plan objectives.
- For each strategy decided to be included in the basin plan, identify clear responsibilities for implementation and funding.
- Integrate selected strategies into a basin plan.

Key outcomes

- Basin plan supported by a transparent decision-making process and supporting information.
- Basin plan developed, outlining strategies to achieve the agreed basin objectives and vision.
- Agreement from stakeholders and relevant governments on the options/strategies outlined in the plan including identification of the trade-offs and who wins/loses.
- Mechanisms agreed to compensate stakeholders that are negatively impacted by the plan.

6.1 Rationale

The core of decisions in basin planning is to identify which strategies will best contribute to achieving the objectives and vision. These strategies may involve policy measures, regulatory tools, development of infrastructure works, or engagement and communication to achieve behaviour change. A range of strategies are discussed in this guide as examples. The best combination of strategies for a river basin plan will depend on the objectives sought, the legislative basis for the plan and the situation assessment in the basin, as well as the results of negotiated trade-offs between different benefits.

Once the strategies to be adopted are decided, they will be integrated into a basin plan. The basin plan itself should provide a coherent framework linking the basin vision, objectives, strategies and implementation actions.

6.2 Critical considerations

6.2.1 Content and timespan of a plan

The following aspects should be considered in a basin plan:

- The basin vision and objectives;
- Strategies to be adopted to give effect to the plan;
- Links to legislative instruments supporting the adopted strategies;
- Identify roles and responsibilities for implementation actions for adopted strategies;
- The methods of compliance to ensure roles and responsibilities are being met;
- Timeline for plan implementation; and
- Linkages with other strategies and linked plans that may support the basin plan.

The lifetime of the plan should be long enough to provide security and stability to water users and managers. It should be reviewed frequently enough to support adaptive management, although it may be appropriate for the legislation to set some limits to how much change can occur in each term of the plan.[6] For example, terms of 5, 10 or 15 years are common.

In the case of legislative plans, the plan may be perpetual, but it is important to provide for mandatory reviews on a five- or ten-year cycle. For example, the Murray-Darling Basin Plan is perpetual legislation, but with a 10-yearly review cycle.

A single integrated, holistic basin plan, addressing the whole system is the fundamental aspiration of river basin planning. However, there may be a need to balance or complement this overall plan with discrete, manageable, governable plans that are "nested" within the overall plan. These nested plans enable focus on specific content and accountability. Nevertheless, clear links need to be provided between the nested plans to trigger integrated consideration. Separate plans (or 'nested plans') might be necessary for:

- different issues (e.g. a water quality plan, an urban water plan, an environmental watering plan and an allocation plan);
- sub-basins or subcatchments; and
- jurisdictional or other legal boundaries, in order to enact legal aspects of implementation.

6 In this context, the term "adaptive management" is used to mean a structured, iterative process of robust decision making in the face of uncertainty, with an aim to review and improve over time based on monitoring and evaluation.

Case study: Nested plans in the Murray-Darling Basin Plan

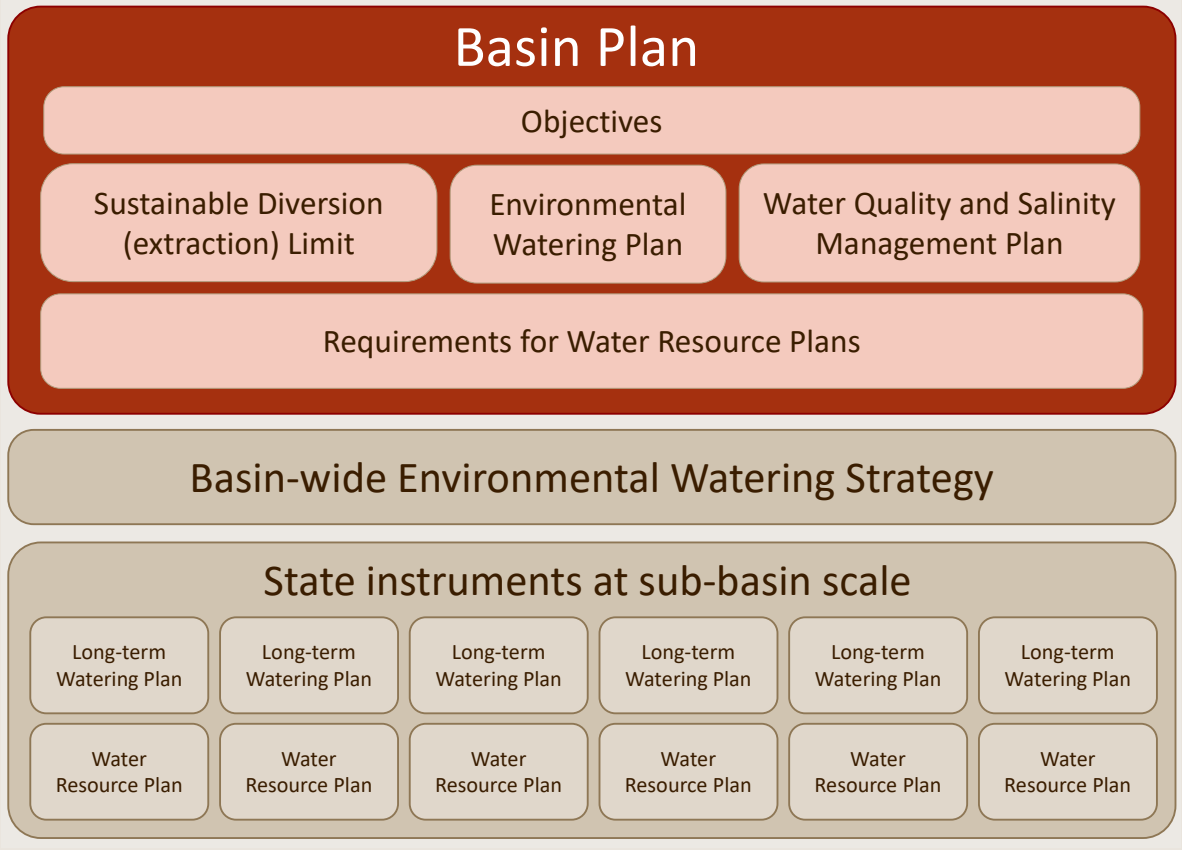
The Murray-Darling Basin Plan includes sub-plans or nested plans within the Basin Plan legislative instrument (as outlined in the figure below):

- an Environmental Watering Plan; and
- a Water Quality and Salinity Management Plan.

The Basin Plan also includes requirements for Water Resources Plans (WRPs) to be submitted by Basin States for accreditation. These WRPs concern sub-basins defined by the Basin Plan. The WRPs themselves include a Water Quality Management Plan for their area. The WRPs also include state legislation giving effect to various aspects of the Basin Plan.

The Basin Plan Environmental Watering Plan requires the MDBA to prepare a basin-wide environmental watering strategy every five years. It requires Basin States to prepare a Long-term Watering Plan for each WRP area.

The Basin Plan includes various requirements for consistency between, and having regard to, the various plans, which are intended to act together to ensure an integrated planning framework.



6.2.2 Process for assessing strategies, negotiating trade-offs and making decisions

A clear decision-making process needs to be established to reach agreement on the strategies for inclusion in the plan, with engagement and input from community stakeholders. Economic, social, cultural and environmental considerations need to be part of options development and evaluation. There needs to be analysis of the effectiveness of each option for achieving the basin objectives, together with an understanding of the costs and the distribution of benefits. A key principle is for decision making to value all kinds of knowledge — cultural, traditional, local, technical and scientific. The decision-making process for development and selection of strategies to be included in a basin plan generally includes (Figure 5):

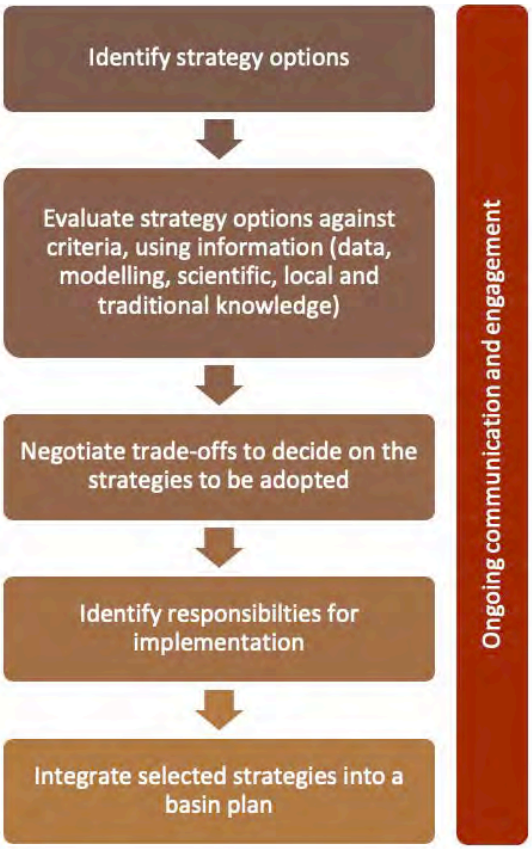


Figure 5. Decision-making process for development and selection of strategies

1. Identify strategies that could contribute to achieving the basin objectives and vision.
2. Evaluate options against clear and agreed technical, social, ecological, and economic criteria linked to the objectives. This step can use a range of decision support techniques, such as risk assessments, multicriteria analysis, economic tools and modelling.
3. Negotiate trade-offs between different stakeholders and making decisions on the combination of strategies which best meets the plan objectives whilst being acceptable to most stakeholders. This may require offsets for those negatively impacted.
4. For each strategy, identify clear responsibility for who is to implement what and by when, as well as how they will be funded (covered further in Stage 6).
5. Integrate selected strategies into a basin plan.
6. *Across each of the above points: Ongoing communication and engagement to ensure consideration of all stakeholder perspectives and preferences.*

Key components of the process are described further below.

Ongoing communication and community engagement

Commitment to genuine long-term and inclusive stakeholder engagement is required to accommodate different interests and perspectives. Planning needs to be people-centred and supported by science which provides important evidence, but does not provide all the answers. This will require ongoing community and stakeholder engagement. This engagement needs to be informed by the situation assessment, modelling and other analysis, in order to inform decisions between options that will each give a different balance of benefits and impacts against plan objectives. This will also inform decisions between sustainability needs and the needs of different stakeholders.

For a plan to be sustainable and enduring it needs community ownership and it needs to be able to be adapted in response to evidence. Countries have had the greatest success in basin planning when options are clearly and transparently canvassed and explicit trade-offs are made with engagement of all

stakeholders. Water planners need to be prepared to work with stakeholders and community through several cycles of considering a range of values, a range of sources of information, a range of options and trade-off decisions.

Evaluate strategy options against criteria

A range of evaluation methodologies are available to compare the suitability of alternative strategies (options) in achieving plan objectives and/or mitigating risks. These option evaluation methods include scenarios analysis, multicriteria analysis (MCA), risk assessment and economic methods. By comparing the performance of different options against different objectives and risks, these methods can inform negotiation of trade-offs to reach an agreed combination of strategies in the river basin plan.

Scenario analysis and use of modelling tools

Scenario analysis for river basin planning considers how various strategies perform to achieve plan objectives under different scenarios. Examples include analysis against different future climate scenarios and analysis against different future economic scenarios. The analysis can inform or consider quantitative data, outputs of hydrological, economic or other models, or it can use qualitative information, such as expert judgements or community input, or a combination. As it provides an assessment of the water available for different uses under varying scenarios, the modelling often forms the basis for the other evaluation methods outlined below (MCA, risk assessment and economic methods).

A key use of hydrological models in basin planning is in enabling running of scenarios of possible future plans to inform the development of policies and strategies. This usually involves the creation of a "base case" scenario against which planning and policy decisions are tested, to evaluate how the river system will respond and what the water supply or flow implications are. For example, models could be used to understand the downstream hydrological impact of the development of a hydropower dam and the potential impacts on downstream agricultural production. Typically, such models are developed with the existing system being represented, but also including future possible scenarios. It is important that these models are able to include the likely variability in system drivers, such as climate, water demands, infrastructure performance (including reliability and failures) and potential or actual constraints such as system needs. Assumptions used in the models must be documented transparently.

Case study: Greater Hunter Regional Water Strategy assessment of future climate scenarios

The Australian State of New South Wales (NSW) has developed a Greater Hunter Regional Water Strategy to plan water resources over the next 20–30 years, including the Hunter River valley and adjacent coastal valleys (NSW Department of Industry, 2018). As part of developing this strategy, future climate scenarios were assessed in a number of ways.

Several scenarios were developed with up to 15 per cent increase or decrease in rainfall and evaporation compared with historic records. Water resources models were then adjusted to increase the evaporation (while rainfall was not changed), thus reducing inflows to, and evaporation from, storages. The results indicated that all storages were sensitive to reduced inflows, while the shallower storages were highly sensitive to evaporation.

In a second step, water resources models were recalibrated with updated data on rainfall, evaporation and runoff, which included a recent drought. The results showed that the model had been under-estimating the consequences of drought.

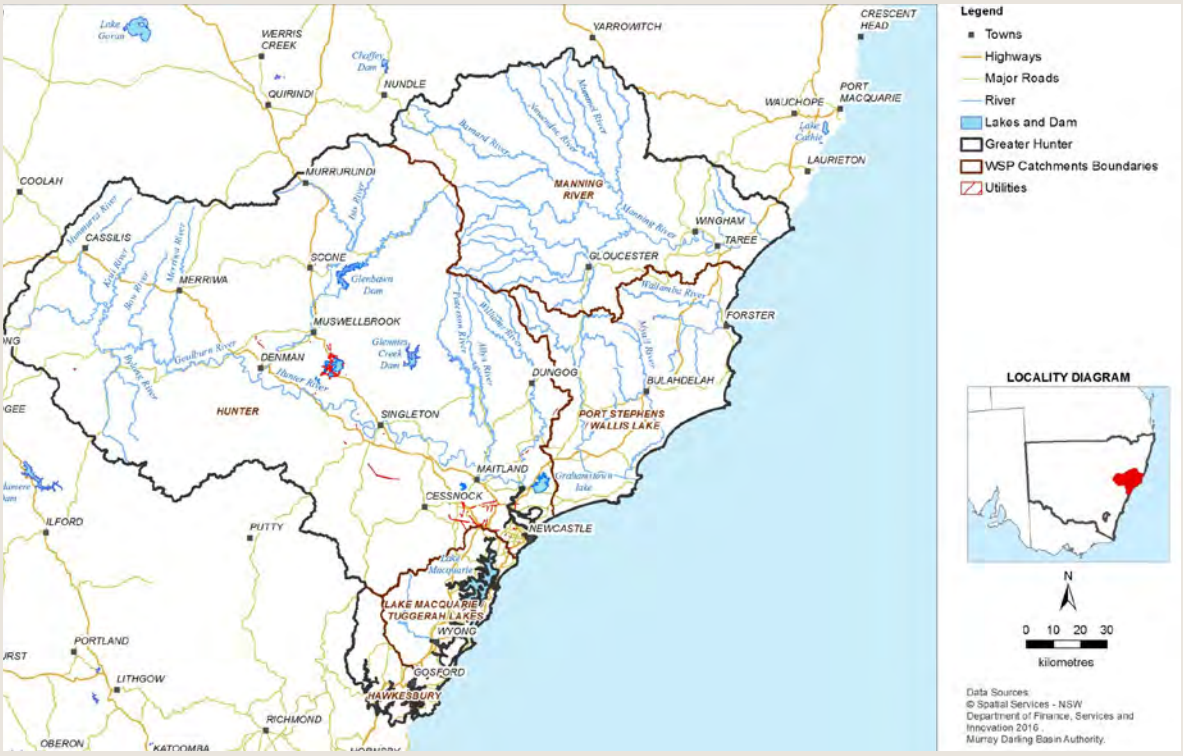
The recalibrated model was then run for a number of infrastructure options to assess their performance in mitigating droughts from the historic climate record (122 years).

A dataset was developed consisting of stochastic data (a random dataset, but sharing some key statistical characteristics with the historic dataset) to simulate variability by producing 10,000 years of records based on historical records. This broadens statistically the probability of climate variability including whether there are changes in such things as averages. As a result, it demonstrates that there is a probability of significantly dryer and wetter conditions than were experienced in the 122 years of record.

This stochastic data was compared to paleoclimate data (that is data from before the historic dataset period — usually derived from ice-core and sedimentary pollen studies). This showed that since the 1500s the region has been experiencing 500 years of average to wet periods of climate. Prior to this there were periods of dryer or average years of rain. Analysis indicates there is a likelihood that dryer conditions will return and will need to be factored into management. The analysis suggested that droughts of 15–20-year duration were possible, and that a drought from 1936–1946 could have a recurrence rate of 1 in 40 rather than 1 in 100 years.

The water resources model was then re-run with the stochastic data to assess the consequences for the infrastructure options, as assessed against water availability for different classes of water users. The results were significant in differentiating each infrastructure option's benefits and their distribution amongst different users.

Finally, an economic assessment of infrastructure and policy options was undertaken, building on the future climate scenarios water resources assessment. The outputs of these studies then informed a multicriteria analysis which scored each of the infrastructure and policy options against their benefits for various objectives. The results have informed NSW's infrastructure and policy priorities in the Greater Hunter, as well as future river basin plans.



Map of the Greater Hunter Region, Australia (credit: NSW Department of Industry)

Hunter Valley, New South Wales, Australia (credit: NSW Department of Industry)

Multicriteria analysis (MCA)

MCA is a decision support tool that was developed as part of a field of study called 'operations research', where decision makers attempt to assess multiple options across a range of decision factors (reasons or considerations), which are called decision criteria. These criteria may have different and inconsistent assessment measures, including non-monetary valuation, because they are measuring different things. Most simple MCAs are developed using an 'analytical hierarchy process' that tries to replicate how humans process complex information. MCA has been adopted for environmental and water management as it is a valuable technique in assessing unique elements of a project that do not have the same units of measurement, or are qualitative in nature (e.g. cultural values). Put simply, it is valuable as a technique for "comparing apples and oranges".

When applied with care and transparency, an MCA can provide a structured and easy-to-use framework for comparing options. It can be an important contribution to the analysis of alternative basin strategies, as it can provide a means of incorporating the relative impact (positive or negative) of different options in achieving policy outcomes. The basic structure of an MCA is shown in Figure 6. Weightings are commonly applied to each of the categories of objectives to reflect their relative importance to decisionmakers. Under each objective, there are typically a number of relevant criteria, against which each project is assessed. These criteria are also typically weighted within the objective to reflect their relative importance. The assessments against each criterion can use either the outputs of previous technical analysis (e.g. a hydrological or economic model), or use a semi-qualitative approach based on expert input or community engagement. It is this approach that allows very different considerations to be incorporated into the same framework of options evaluation.

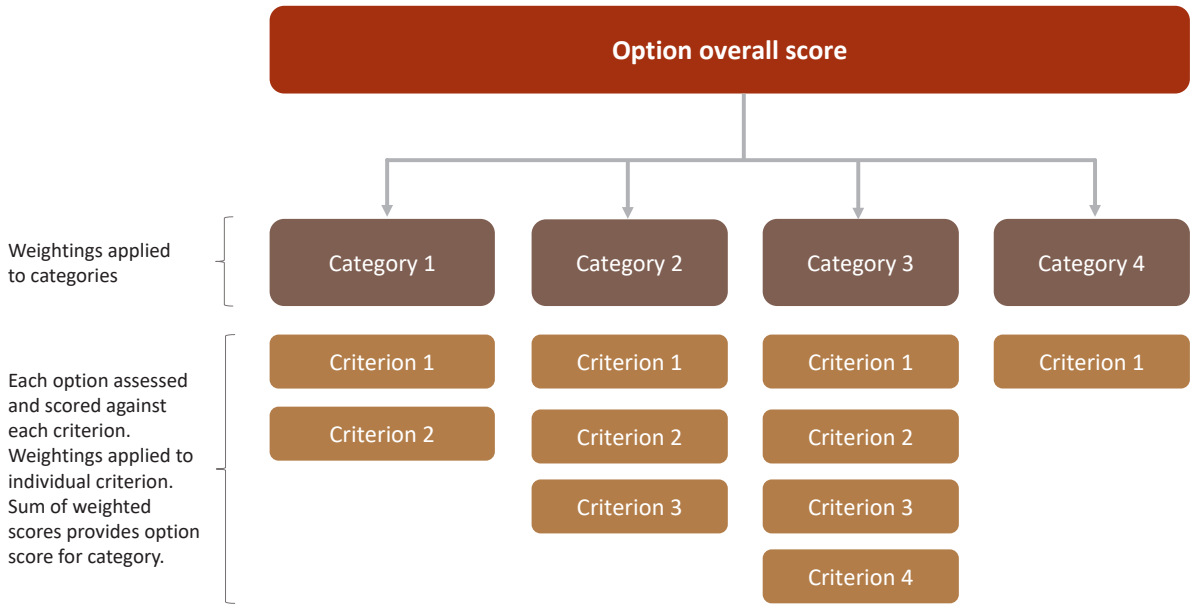


Figure 6. Typical broad structure of a multicriteria analysis

MCA is most effective when there is a very clear basis for scoring options against criteria and where this evaluation framework is agreed and documented before the analysis has commenced. However, MCA ultimately involves some subjective and non-testable judgements on values, but provides a structured and transparent framework to evaluate these judgements.

Criteria form the focus and content of an MCA analysis, representing the diverse values and ways to evaluate a project option (that is, the different decision considerations or factors). These criteria are assessed individually, for each project option, and given a corresponding score. Examples of criteria include recreational impact and impact to local economy.

The assessment will vary for each criterion and will provide the data required to implement the MCA. Some of the assessments will be quantitative, such as calculating a dollar figure, and others will be qualitative, such as a low, moderate or high rating to represent the level of impact. Some assessments will require technical input from experts and others will rely on community engagement to find out about social and cultural values.

Importantly MCA does not make decisions, it provides perspectives that can be used by decision makers to reflect on the merits of different options.

Using risk management approaches

If a risk assessment has been undertaken to identify high risk issues for the basin, this can be used to inform options evaluation. If so, the next step in the risk assessment process is to focus on the medium- and high-rated risks and identify measures that will mitigate the risk. The post-mitigation risk is then assessed to identify where the greatest benefit can be achieved. Developing a thorough assessment of the measures available to mitigate those risks can help identify high priority issues.

Once these high priority issues have been identified within each state or region of the river basin, and across the whole of the basin, management options can be considered. Options analysis (e.g. multicriteria, benefit-cost), including the triple bottom line (economic, environmental and social considerations), is essential to employ at this stage, again, with full engagement of stakeholders to inform the options development and analysis process.

Application of economic tools

Application of economic tools can help planners and stakeholders to identify which development, or water policy, option offers the greatest value (i.e. utility) to society. Various methods are available including cost-benefit analysis (CBA), cost-effectiveness analysis (CEA), distribution of benefits analysis, environmental and social impact assessment, and development of a business case for investment. More recently, Australia and other countries have increasingly applied multiple tools to assess options, which go beyond traditional CBA, to include environmental costs and benefits, and draws in benefits such as ecosystem services, liveability, and cultural values (e.g. quadruple bottom line reporting).

Negotiate trade-offs to decide on the combination of strategies and tools to be included in a plan

An understanding of the impacts, costs and benefits of strategy, and tool options and combinations, provides a basis for negotiating trade-offs. For example, trade-offs between alternative economic, social, cultural and environmental basin objectives, between system needs and extractive requirements, between existing and potential future demands, or between economic benefits and mitigation of pollution or floods. Negotiating these trade-offs is difficult but is at the core of making decisions on which strategies are to be included in a basin plan.

The process for negotiating trade-offs will depend on the basin context, but should always be informed by the agreed basin vision and objectives as these provide the agreed priorities for the basin's future. It should also always be informed by ongoing stakeholder engagement, as trade-offs that are completed in consultation with affected stakeholders are more likely to be accepted.

One of the most challenging tasks for leaders in basin planning is to make and enforce decisions that require trade-offs between different water uses and users. Including an independent RBO at the decision-making table is critical to inform appropriate water policy and planning decisions based on a sound understanding of the costs and benefits of strategy options (i.e. the trade-offs involved in decisions) across economies and societies as a whole, rather than just at a local scale.

Gaining agreement for these trade-offs will need consideration of what incentives, and offsets for negative impacts, can be made available for those who may be losing out from river basin planning decisions. For example, governments may decide to provide assistance for farmers or other industry to increase water efficiency, change crops or reduce pollution. The incentive or support package should result in no net disadvantage, in particular to vulnerable groups in society. One critical part of negotiating trade-offs is to engage the Indigenous interests and include cultural knowledges, values and perspectives to mitigate impacts on individuals and communities.

Case study: Trade-offs and incentives to compensate for losses

The Murray-Darling Basin Plan and earlier state-level reforms involved a redistribution of water from consumptive users (mainly irrigated agriculture) to the environment. The water available for consumptive extraction was reduced by approximately 15.5 per cent over the long-term, to reach a 'sustainable diversion limit' (MDBA, 2020).

This significant change was accompanied by a broad package of reforms and funding. Reforms included the conversion of previously insecure licenced volumes, to secure property rights separated from land and able to be traded and used as security. The property rights have associated water accounts that are credited with water volumes according to availability in the system and with a range of account features that enable holders to manage their own risk (for example by choosing whether to use water, save stored water, or trade water). The creation of these property rights and the associated account management tools and water market has created significant benefits for agriculture, while some impacts and risks are also becoming apparent (see case study on water markets).

Alongside this property right reform, the Australian Government allocated a significant budget to funding and various other measures to assist the transition to a more sustainable level of extraction. Governments entered the water market to buy water rights directly and these are now managed under legislation for environmental benefit, by a 'Commonwealth Environmental Water Holder'. In addition, governments have funded or co-funded a range of measures to improve water-use efficiency, both on farm and in irrigation delivery schemes. These measures are funded in return for a portion of the water savings being returned to government for environmental purposes.

The combination of these measures and others has enabled a reform that benefits both the environment and industry overall. However, some communities highly dependent on irrigated agriculture have seen impacts from the reform, especially when it has coincided with both extended drier climate conditions and broader rural social and economic change. There have been calls for further assistance to these vulnerable communities.

Multibay flumegate regulator, Macalister Irrigation District (credit: Southern Rural Water)

Case study: Options assessment for urban water supply infrastructure planning for Canberra

The Australian capital city, Canberra, sits within the Australian Capital Territory (ACT), surrounded by the state of New South Wales, in the Upper Murrumbidgee River catchment, in the Murray-Darling Basin. The city's population in 2020 is approximately 420,000. The ACT administration regularly reviews water supply and security against population changes, climate projections and recorded inflows to storages.

Following a 2005 review, the ACT determined that without augmentation of supply, the city would face extended water restrictions and risk of running out of water. Several options for augmentation were assessed and consultation was held with stakeholders and community groups. Options were shortlisted based on economic assessment and other decision criteria. These options were subsequently adopted by the ACT Government.

By 2007, extended periods of historically low inflows (part of the Australian 'Millennium Drought') led to a re-evaluation of the options. Hydrological, economic and other studies compared options for new dams, enlarged dams, intercatchment transfer pipelines, re-use of treated wastewater, and even desalinisation of seawater and pumping from over 100km away and a raise of 600m above sea level.

Hydrological, economic and other studies showed that desalinisation and pumping was uneconomic, treated water re-use was of some benefit but did not yield adequate supply, and a proposed new dam site was in a catchment suffering significant reductions in inflows. However, the intercatchment transfer scheme, in combination with an enlarged dam at an existing site, provided significant increased yield at a lower cost and quicker delivery time than other options, including new dams. The ACT Government decided to adopt the recommended options, which proceeded to further environmental assessment, design and construction.

While this case study did not include a river basin-wide assessment of options, it provides an example of careful assessment of hydrological, climate, economic and other information. This showed the proposed new dam was not the best option to improve water security in the best timeframe and cost. Information for this case study was sourced from the ACT Electricity and Water Corporation (ACTEW Corporation, 2009).

Cotter Dam and Cotter reservoir near Canberra, Australia (credit: Juergen Wallstabe/Adobe Stock)

6.2.3 Strategies available for river basin planning

The following sections outline a range of strategies that could be adopted in the development of a basin plan. When combined, the strategies provide an approach that will be relevant for most basin planning contexts, particularly where the focus is on sharing access to a water resource, but they can also be utilised separately. There are also other strategies that can be adopted within a basin plan. The best set of strategies for each river basin plan will depend on the basin vision and objectives, the starting point, the basin context and the situation assessment for that basin.

The strategies presented in this section can be linked and are most effective when adopted together as outlined in Figure 7.

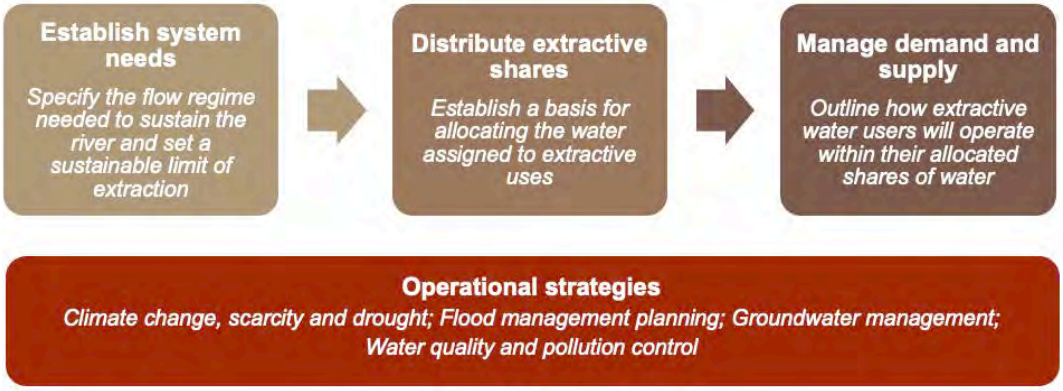


Figure 7. Linking basin plan strategies

System needs and sustainable extraction limits

The 'system needs' strategy specifies what flow regime is needed to sustain the river and water-dependent ecosystems, and sets an overall limit to extraction to achieve the flow regime. This provides the basis to establish the shares of water between system needs (generally non-extractive) and other water users (generally extractive).

System flows are the flow requirements that are essential for non-consumptive (or non-extractive) purposes such as environmental and cultural purposes and in-stream production needs (e.g. fisheries), as well as for extraction for critical human water needs for drinking, sanitation and domestic food production, for navigation and for water quality. A system flow may take the form of a minimum flow or may be as complex as the definition of specific flow regimes. The exact definition of what is included in the system flow may depend on the context of the river basin, its governance and the starting point.

The system needs, or sustainable diversion limits, approach can be applied to both surface water and groundwater. Where surface water and groundwater are highly connected, limits for both should be established to support integrated water resources management.

Methods for defining system needs vary widely depending on the underlying focus. For instance:

- **Value-based approaches** which use values-based objectives to frame decision making. This involves consultation on cultural, social and economic needs, followed by the determination of flow/volume requirements from the resulting policy principles and objectives;
- **Supply-focused** methods focus on optimisation of supply against an agreed series of requirements using historical climate and flow data, as well as analysis of future scenarios of climate, economic change, population and per-capita consumption;

- **Economic** methods focus on assessing utility, enabling assessment of which options and industry demand scenarios deliver the best utility, measured in terms of various economic statistics;
- **Social** methods consider social change, social values and a strong emphasis on inclusive engagement; and
- **Environmental** methods establish environmental objectives and the flows needed to meet those objectives. Common environmental methods include the Building Block Method and holistic approaches (King *et al.*, 2000; Tharme 2003).

Once the system needs and system flows are established, it is important to establish a corresponding limit to extractive uses. This limit provides the basis for certainty for those depending on system needs and flows, while also providing stability and certainty for users within the extractive share. Maintaining extractions below the set limit requires ongoing monitoring and reporting, as well as a clear mechanism for maintaining compliance with the limit. The sustainable limit to extraction from the water resources is the level of extractions that can be sustainably maintained in the long-term without irreversible damage to environmental values, and without compromising critical human water needs, water quality and cultural values (in the Murray-Darling Basin Plan, this limit is called the 'sustainable diversion limit').

It is important to recognise that the decisions involved in establishing system needs and sustainable limits for river basin plans involve much more than technical and scientific input (critical though this is). There are significant economic and social issues at stake. For this reason, the choices need to be built on careful engagement and negotiation with affected groups, with a key role for governments in considering the right balance for the future. This also means that the system needs flow adopted within a basin plan may be a negotiated compromise that does not fully meet the system requirements but allows for the basin planning to move forward.

Once system flows are established, they can be delivered in a range of ways. Approaches include passive management (e.g. rules-based approaches such as imposing licence conditions for water users to prevent extraction of system flows) or active management (e.g. the creation of environmental entitlements to water) (Aither, 2018).

In a closed basin, the decision on the sustainable diversion limit and how it is delivered will be particularly challenging when the analysis shows that existing extraction exceeds the sustainable limit. If critical human water needs and environmental values are not to be irreversibly compromised, strategies will need to be developed to return extraction to a sustainable level. Strategies available may include developing methods to limit extraction and "share the pain" between users, such as by a proportional reduction in everyone's extraction, or to over time close down certain industries, perhaps those that have the least economic value or those that will affect the least number of people. Other strategies may include "buying out" some water users through voluntary participation (this was the chosen strategy in the first phase of implementation of the Murray-Darling Basin Plan), or funding infrastructure to improve water use efficiency in exchange for a reduction in volume extracted (a later strategy in the implementation of the Murray-Darling Basin Plan).

Most strategies are best implemented over a long timeframe to enable gradual adjustment. The decision on strategies to reduce extraction to sustainable levels needs to carefully consider the impact on vulnerable people and regional/rural and remote communities.

Key steps in establishing system needs and sustainable limits on extraction include:

- Define a system flow regime that enables water to be delivered to users, supports navigation where relevant, maintains water quality, and supports environmental, cultural and other needs;
- Establish an agreed priority hierarchy of uses so that in times of scarcity, water can be allocated to the most critical or highest priority water needs;
- Develop a mechanism for allocating water between system needs and extractive uses — the mechanism needs to be responsive to seasonal, monthly and decadal changes in climate; and
- Develop a regulatory framework to enforce the defined system flow regime and allocation mechanisms, since this provides stability and security for economic development.

Distribution of the extraction share between states and between water users

Once the system needs are agreed and a limit to extraction at basin level defined, a basis for distributing shares of the allowable water extraction volumes between states/provinces and other major stakeholders (such as irrigation schemes and other industries) needs to be established.

The states/provinces or irrigation schemes or other collective sector users (e.g. agricultural, industry, domestic) will then need a mechanism for allocating water access to individual users. The allocation mechanism needs to enable adaptability while providing clear and predictable rules for how water is made available to users, how users manage their access to water, and how water is distributed between individual users. The framework may be part of the river basin plan or this may occur through state instruments that are linked to the river basin plan. The framework is likely to interact with tools and strategies for demand and supply management.

Examples of allocation mechanisms are described below:

- **Extraction limits** set a limit on the extraction of water. This needs to be undertaken in consultation with all water users in the basin to ensure the adoption of the limits;
- **Water rights, entitlements or permits** establish a legal framework for water access. They specify the quantity of water available to a particular user, as well as the source, timing, reliability of supply, type of use and duration of access (Richter, 2016); and
- A **water allocation plan** sets out the rules for managing the extraction of water from a river or aquifer to ensure that system needs and other users' needs are met, while being responsive to climatic variation in the availability of water.

Approaches for allocating water need to take the changing climate into account. This could be done, for example, by regular review of extraction limits or allocations, by establishing dynamic allocation of water that changes according to availability (at a monthly, season or annual time scale) or by using market mechanisms to respond to climate variability.

Case study: Australian frameworks for adjusting water extraction in response to a varying climate

Australian States in the Murray-Darling Basin have developed a framework over many years that enables the amount of water that can be extracted to respond to highly variable water availability. This variability is usually in response to hard-to-predict climate cycles of dry sequences of years and wet sequences of years. Key elements of the framework are briefly described here but have been greatly simplified for the explanation (further information is available on the MDBA website under 'Allocations, the states and the MDBA').

State water plans (or similar instruments) set a limit to extraction, which is intended to prevent unsustainable extraction increases over the long-term. Within this limit, shares (volumes of water) are distributed through various categories of licensed 'entitlement'. Within this maximum entitlement share, 'allocations' are made within a water year, such that within a year of high-water availability, a 100 per cent allocation will be available. Within a year of low water availability, the allocation may be 20 per cent or even zero of the entitlement volume, depending on the category of entitlement. The different categories of entitlement offer different levels of security (assurance of supply). For example, in New South Wales, a 'High Security' entitlement may get more than 95 per cent allocation in 95 per cent of years, whereas as 'General Security' entitlement may get more than 95 per cent allocation in only 50 per cent of years. The exact reliability depends on the hydrology and infrastructure characteristics of each sub-basin/catchment.

Figure 8 provides a conceptual illustration of this concept. As the volume of water available (permitted) for extraction grows and shrinks, the individual entitlement holders' water allocations (as well as state proportions) grow and shrink proportionally (the mechanism is more complex in practice).

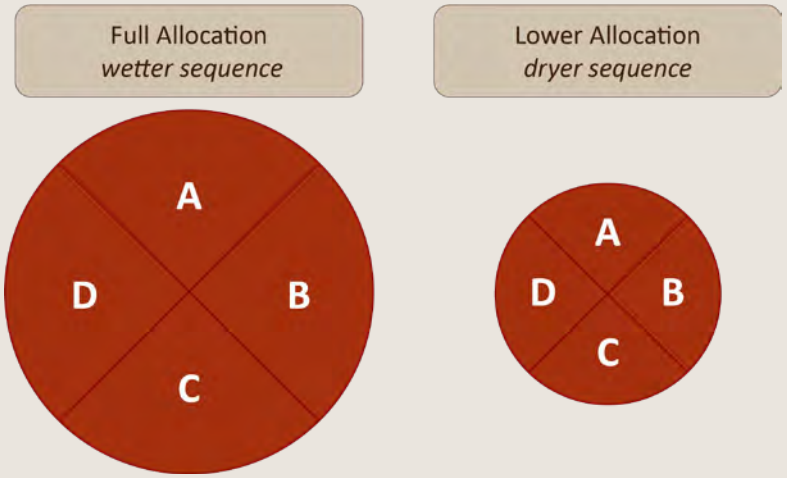


Figure 8. Australian framework to enable water allocation volume to respond to variable water availability

In Figure 8, four water users hold entitlements, in this case each hold 25 per cent of the total available water for extraction (within the sustainable limit). During a wetter sequence of years, their water account receives full (100 per cent) allocations, each 100 per cent allocation being 25 per cent of the available resource. During a dryer sequence of years, their water account receives lesser allocations, but for each of them, this lower allocation is still 25 per cent of the available resource in those dryer years. Note that this example is highly simplified and in practice the system is more complex, with more shareholders, several different categories of entitlement, each giving different reliability responses to variation in water availability.

Further mechanisms that allow extraction to respond to variable water availability include carryover rules that allow a portion of unused allocation to be carried over in the water account to the next water year, and water trading, enabling sale of unwanted allocation or entitlement and its purchase on the market by those who seek more water (see case study below describing Australian water trading).

Demand management

The objective of demand management strategies is to provide a range of incentives and tools for water users to manage their water use most effectively and efficiently, within their share or allocation, in response to variations in water availability. Demand management provides water users with mechanisms to decide how they use the water made available to them, within a framework of clear and consistent rules. For example, an industry may be able to reduce water extraction in a time of scarcity if it is able to store water, or if it is able to plant crop types with a lower water use. Many of these tools will also link to other strategies in the river basin plan.

Key principles for demand management include:

- There is a limit to how much water can be extracted for consumptive use while maintaining the health and productivity of the water source recognising climatic and seasonal variability;
- Demand is best managed at the scale appropriate to users. For instance, there is considerable opportunity for voluntary cooperation by water users (e.g. timesharing of pumping bores, rostering of pumping from surface water) at a local scale;
- Water is a highly valuable resource and there is increasing demand for water for competing needs;
- Reduce demand for water wherever possible and maximise water use efficiency;
- Recognise that there is a cost for implementing demand management;
- Recognise the Indigenous demands and needs as well as aspirations.

There are a range of options available for demand management — ranging from policy and economic mechanisms to incentivise users to manage their water demand, to technologies that assist in making the use of water more efficient. Some example demand management strategies are described below:

- **Voluntary cooperative systems** occur when a number of users of a common resource voluntarily agree to manage their water demands. For example, on small watercourses or aquifers, or in a village, water users and farmers may voluntarily agree to roster their pumping to avoid a sudden depletion of the water source;
- **Establishing simple rules** such that users can be clear on the water allocations they will receive under different climate conditions, and plan accordingly. For example, in many river systems in Australia where water is stored in dams, water users have their own 'water account' and can manage their own water risk by withdrawing water or saving water from one year to the next, much like a bank account;
- **Water pricing** encourages efficient use of water by placing a price on water by volume that reflects the cost of extraction and distribution;
- **Water markets** encourage water to be used for its highest value by enabling the trading of water allocations (or entitlements or permits). However, establishing markets and trading requires sound and transparent governance mechanisms, a limit on water extraction, clear allocation rules, supported by data collection (including metering) and a robust framework of regulation, compliance and enforcement (see case study below);
- **Water saving technologies** include improved irrigation systems, reduction of leakages, domestic water savings measures and changes to industrial processes.

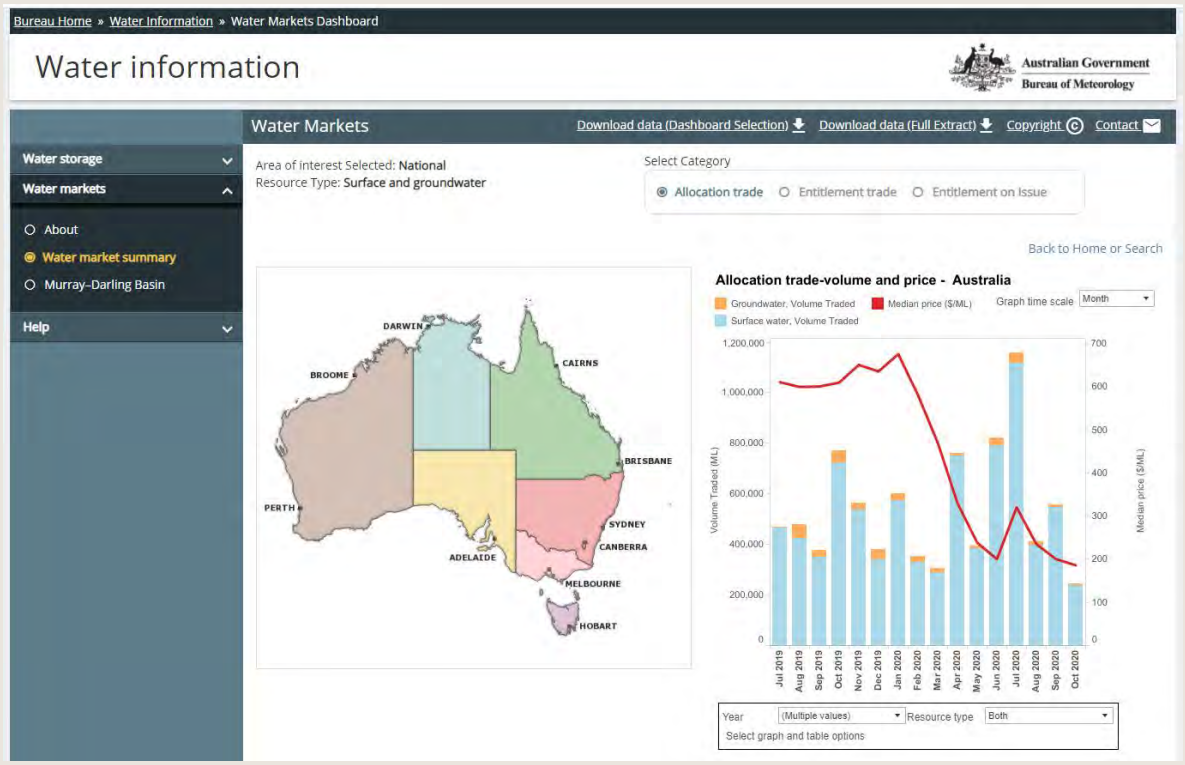
Case study: Water markets in Australia

In Australia, water markets were established as part of a package of reforms in response to increasing water scarcity. Fundamental to their establishment in Australia was the adoption of a cap and trade system across large parts of the Murray-Darling Basin. This system gave water users the entitlement to own a share of the available water supply from a water resource (which can vary with water availability), and the right to trade these shares (Goesch *et al.*, 2019). These tradeable entitlements are separate from land title and do not specify the end use. There are two main tradeable elements: trading of the ongoing ('permanent') share in the water resource; and trading of seasonal 'allocations' in the current years' water resource.

Australia water markets function like a stock exchange with willing sellers advertising their water for sale or loan on an internet bulletin board at a specified price (Richter, 2016). Irrigators are the primary traders in Australian water markets, with other traders including urban water utilities, mining companies, agricultural processors, managers of environmental water and investors (Goesch *et al.*, 2019).

Water markets have enabled water to be "reallocated" to high-value uses and to maximise overall economic value of agriculture even during droughts. However, there are diverse views about water markets. They are seen by some to have negative consequences as they move water-dependent economic activity away from some areas dependent on water-related industries for employment.

Importantly, water trading can only take place where sound and transparent governance mechanisms are in place, a limit on water take has been established (a 'cap'), and an agreed upon allocation system has been established supported by quality data collection and management (including metering) and robust compliance systems. Water trading is not an appropriate system to use without these necessary conditions being satisfied.



Australian water markets website dashboard on 27 Oct 2020 (credit: Bureau of Meteorology)

Supply management and planning resilient infrastructure development

The objective of supply management is to develop strategies that increase availability of water or improve reliability of access to water, while maintaining the health and productivity of the water resource (system needs and flows). This is most often addressed by development of storages and by development of water distribution networks, but may also include use of groundwater, desalination and water reuse.

Key principles for supply management include:

- There is generally a hierarchy of uses established so that domestic use is prioritised, and always receives its share of the water resource so that critical human water needs are met.
- Maximise water availability for productive uses (e.g. domestic use, agriculture and industry) within the extractive share of the available water resources, while maintaining the health of the water resource.
- Ensure that water users have as much control as is feasible to meet their water needs, within a framework of clear rules and reliable access to their share of the resource and within the context of variability in water resources.
- Recognise that continuing to construct major new infrastructure may be associated with diminishing economic returns, and that benefits can come from maximising the efficiency of existing water supply infrastructure, for example, by linking dams through pipeline networks.
- Supply management is best approached at the most appropriate scale that depends on the water resource and the different uses. For example, the adoption of alternative water supply options at a local scale — e.g. water recycling, rainwater harvesting — provides opportunities to expand the amount of water available for water users at that scale.
- Strategically planning for water infrastructure as part of a basin planning process provides the opportunity to optimise investment in infrastructure and to avoid mistakes many countries have made in over-development and uneconomic development. Therefore, the river basin planning process should be used to consider infrastructure development plans in an integrated, holistic and basin-wide context. When looked at together, it may become clear that some projects conflict with each other, or cannot be justified on hydrologic, environmental or economic grounds.

There are a range of options available for supply management strategies. Some examples are described below:

- **Development and management of infrastructure** allows for water to be stored for later use, meaning that it is regulated and made available as needed by water users.
- **Farm dams and tanks** allow for private storage of water, whether harvested from catchment runoff, overland or floodplain flow, or pumped from the river or groundwater for future use. Farm dams can play a significant role in supporting irrigation and stock water supply and therefore agricultural productivity. However, the distribution and development of farm dams can have a significant cumulative impact on catchment runoff, as well as floodplain flows and harvesting of flood events.
- **Water recycling** involves treating water that has been used so that it can be reused for the same purpose or used again for a new purpose. The risks to water security from climate change and over exploitation of water resources can put pressure on governments to develop new sources for potable water. For instance, treatment of wastewater (sewage or stormwater) to an acceptable standard of potable water or other uses is already a feasible scenario in many circumstances. International experience would suggest the primary challenge to these approaches is community acceptance of treated water for drinking purposes. In addition, strict regulation is required on treatment standards, to avoid pollution of drinking water.

- **Rainwater harvesting** involves the collection of water from roofs or other non-permeable surfaces for storage and use. By collecting water in a decentralised way, the need for large storage dams can be reduced and water can be supplied for domestic and small-scale uses.
- **Managed aquifer recharge** involves intentionally recharging water to aquifers for later extraction. By using an alternative water storage approach, the need for large storage dams can be limited whilst reducing evaporation and still guaranteeing supply to water users.
- **Desalination** involves removing minerals from saline water to develop potable water. Utilising the sea or other brackish water as an alternative water source provides a more reliable supply as it is not reliant on rainfall.

Preparing for water scarcity and drought

Managing water shortages during scarcity and drought needs to consider both setting high-level policy and principles as well as clear and practical planning and operations.

Setting the high-level policy and principles for managing water scarcity involves ensuring that the agreements and rules for how water is shared are designed to be responsive to scarcity. This may involve volume thresholds or percentage shares that vary the agreed distribution of water depending on availability. Another important consideration is to set enduring rules about priority of access to water during shortage, for example between states/provinces or between irrigation districts and cities.

Implementation and operational planning for drought requires the development of a coherent set of strategies to reduce the risk and impact of drought. The full set of drought management strategies may be included in the basin plan, or the basin plan may clearly outline the requirements, principles, responsibilities and schedule for developing a separate, but linked, drought management plan.

The drought management plan needs to ensure that drought responses are developed long before a drought takes place by including clear objectives and hierarchies of operation to prepare a response to drought. Responses may be structural (e.g. storage infrastructure, interbasin transfer infrastructure, water grids, water efficiency improvements) and non-structural (e.g. limiting water access depending on water availability, using water markets, introducing public water saving campaigns). This can apply to both supply and demand management.

The drought management plan also needs to provide for emergency response mechanisms and tiered response plans for extreme drought events. Response plans may need to identify clear thresholds for what constitutes “extreme” or “emergency” — for example, when storages fall below a certain level or inflows have been below a certain level for a number of months or years.

Another key issue for consideration in a drought management plan is the need to retain enough water in the system to enable the flow or transmission of water for essential purposes downstream in the system, i.e. allow conveyance water for evaporation, seepage and transmission losses to groundwater during dry times.

A key challenge in developing a drought management plan is understanding the intensity and frequency of droughts for a given basin. A common approach is to gauge the duration and intensity of the worst drought in the historical record, and to retain sufficient water to provide for supply of essential needs through such a drought. Drought planning, however, should consider the potential impacts of climate change, noting that the historical record is unlikely to include the full range of possible future drought sequences likely with climate change. The strategies should therefore be assessed against the climate baseline and climate change scenarios, as discussed in the Situation Assessment in Stage 4 of this guide.

Even if a full drought management plan is not provided within a basin plan, the basin plan can still be an important document in confirming social priorities, which usually favour domestic and urban water supply and electricity generation water requirements ahead of agricultural and industrial requirements. There may be priority differences even within a sector — for example, priorities may favour permanent plantings over annual crops or favour food crops over other crops. As part of water allocations, the basin plan will often nominate priority water users, and how many years of storage should be retained for priority users before water is allocated and released for other users. In addition, the plan should confirm where environmental water requirements sit in the list of priorities.

A key consideration in planning for drought is to plan for the water needs of remote and isolated Indigenous communities. Engagement will be paramount in planning for sufficient water infrastructure.

Case study: Strategies used in the Murray-Darling Basin to respond to water scarcity

The Murray-Darling Basin Agreement establishes water sharing arrangements between the three States of New South Wales (NSW), Victoria and South Australia. In a simplified summary, NSW and Victoria share inflows to the River Murray, while South Australia is guaranteed an annual flow at its (downstream) border. These arrangements have endured more or less unchanged since they were agreed between 1914 and 1917. State officials and Ministers meet periodically to discuss implementation and provide direction to the River Murray Manager (now the Murray-Darling Basin Authority, previously the Murray-Darling Basin Commission and originally the River Murray Commission).

Map of the Murray Darling Basin (Source: abc.net.au)

Since 2012, the Murray-Darling Basin Agreement and the Basin Plan have included arrangements for "Critical Human Water Needs". These provide an arrangement of three "tiers", whereby increasing water shortage, at defined trigger levels, will trigger escalation of management arrangements to a higher level. This is necessary on the River Murray because South Australia's capital city, Adelaide, and several other urban centres have a strong reliance on water supply from the river. Given the length of the Murray and the distance of over two thousand kilometres from the headwater storages to South Australia, provision must be made for significant storage of 'conveyance water' as well as the urban water supply in order to allow for high-transmission losses to evaporation and groundwater, as water moves down the system during extended dry weather.

Similar tiered response arrangements are also used for "extreme events" and emergency response plans to address critical human water supply at the state and regional level across the basin.

In New South Wales, water legislation establishes priority of access, being firstly for domestic use, then for the environment, Indigenous needs and for "basic rights" for stock and domestic use, then for use for utilities (power and water supply) and only after these for irrigation and industrial use. During extreme water shortages, the Minister can override the environmental priority for the short-term, while arrangements can be made for returning water to the environment when the crisis is over.

Flood management planning

Flood management requires the development of a coherent set of strategies and plans designed to reduce the risk and impact of flooding, while maintaining the environmental, cultural and agricultural benefits of flooding. The full set of flood management strategies and plans may be included in the basin plan, or the basin plan may clearly outline the requirements (e.g. operation manuals), principles, responsibilities and schedule for developing a flood management plan.

Flood management planning should consider the potential impacts of climate change which may make floods more prevalent and more intense. Flood planning should therefore be assessed against the climate baseline and climate change scenarios, as discussed in the Situation Assessment in Stage 4 of this guide.

Approaches for flood management may include: i) non-structural (rural and urban land use planning and land management), e.g. floodplain zoning, emergency responses; ii) non-structural (river operations), e.g. dam management rules; or iii) structural, e.g. reservoirs, levees and weirs designed specifically for the prevention or mitigation of flood damage.

For non-structural approaches, a flood management plan needs to outline the legal situation and provide guidance on issues such as land-use regulations (building in floodplain restrictions), awareness campaigns, flood warning systems and flood emergency preparedness plans. Floodplain management plans can establish clear objectives and recognise the benefits and impacts of flooding. Floodplain management plans can provide clarity for land-use and emergency planning by defining flood pathways that are adequate to convey floodwater without posing unreasonable risk to life and property. The flood pathways are derived from observations of actual floods (e.g. by remote sensing) combined with hydraulic modelling.

For structural approaches, to ensure that infrastructure is managed to reduce flooding risk, a flood management plan needs to provide provisions for a clear hierarchy of objectives and an operational manual for each dam and weir in the basin. The hierarchy of objectives normally includes: i) ensuring the structural integrity of the dam is maintained; ii) preventing unnecessary flooding of towns downstream; iii) preventing flooding of agricultural land; and iv) maximising the amount of water retained in storage through active management of air space. All of these objectives need to be considered against the environmental values supported by flooding, such as floodplain wetlands. Floodplains play an important role in environmental health and cultural benefits. For operators of dams and weirs, an operational manual provides clear guidance on actions to take during flood emergencies and who is responsible for initiating these actions.

It is important to recognise that floods play an important role in cultural benefits, such as the long-term sustainability of Indigenous native foods for harvesting and medicinal purposes for Indigenous Peoples and communities.

Groundwater management and integration with surface water

BasinGuide focusses mainly on surface water planning for river basins, whilst recognising the importance of groundwater–surface water interactions and of the need to undertake similar groundwater planning. Many of the principles and approaches in this guide will also apply to integrate planning of groundwater resources. This includes, for example, developing an extraction limit and rules about how and when groundwater can be taken.

Decisions of groundwater management strategies will need to be taken, with stakeholder engagement, as a part of the basin-planning process. These decisions are informed by the situation assessment and by further information and analysis on basin priority issues, options and trade-offs. This further information

may include hydrogeological analysis and modelling, as well as water quality and geochemical assessment. Key strategies to consider for groundwater management include:

- **Extraction levels:** The sustainable level of groundwater extraction and whether current extraction is greater or less than the sustainable level. If current extraction exceeds the sustainable level, it may need to be reduced to bring it back to sustainable levels, while extraction less than the recharge may mean that additional water is available for use.
- **Suitability of the water for the end use:** Where groundwater systems naturally contain high levels of pollutants/contaminants (e.g. arsenic) that are a risk to human or animal health, it may be necessary to restrict use or to treat the water and/or conduct awareness campaigns to users. Where systems are contaminated from pollution or at risk of contamination, restrictions on bores in some zones may be necessary. If salinity or sodicity issues limit suitability for irrigation of some crops, this may require governments to work with farmers to manage the issue.
- **Connectivity to surface water:** Where groundwater is identified to be highly connected to surface water, it may be necessary to restrict/limit groundwater access to prevent impact on river flows, especially in dry conditions.

A river basin plan can provide rules to address the overuse or pollution of groundwater resources. This could include: i) wellhead protection plans that may require exclusion of new bores within a certain distance of existing bores; ii) time limiting of pumping to prevent exacerbation of cones of depletion and the pollution of aquifers by drawing in poor quality water from other strata; iii) land use planning; iv) exclusion zones around current and future critical urban water supplies; or v) education and awareness on the need for groundwater protection.

Both surface water and groundwater management strategies will need to consider the likely connections between surface water and alluvial groundwater. For example, when flows in the river are low, there may be a tendency to extract more groundwater. If there is a strong connection, this may further deplete river levels and compound falling groundwater levels.

Water quality and pollution control

Water quality management requires the development of a coherent set of strategies and plans to safeguard the water quality within a river or aquifer. The full set of water quality strategies and plans may be included in the basin plan, or alternatively the basin plan may clearly outline the requirements, principles, responsibilities and schedule for developing a water quality plan. It is important that the water quality strategies align closely with those in the overall basin plan, but they may need a specifically focused (or 'nested') plan for higher priority water quality related issues (e.g. improving drinking water quality).

Key steps for developing water quality management strategies include:

1. Establishing surface water and groundwater values and uses in a river basin. These are also called water quality objectives or beneficial uses. They may include, for example, drinking water, recreational water, animal/stock water, irrigation water, or water for ecosystems;
2. Identifying the water quality standards (also called technical criteria or trigger values) for each of the identified values and uses;
3. Establishing monitoring programs to identify areas where water quality standards are not being met and develop a hierarchy of risks which threaten the identified values and uses;

4. Defining management actions for locations or areas where water quality standards are not being met or are at risk. These actions can focus strategies to achieve water quality objectives. The actions might include water and wastewater treatment, prevention or treatment of industrial wastewater point-source discharges, addressing diffuse sources of pollution in urban stormwater and from rural agriculture, and building infrastructure that delivers good quality water for remote and isolated Indigenous communities;
5. Monitoring, compliance, evaluation, reporting and learning to ensure actions are implemented and to evaluate their success in achieving objectives (see Stage 7).

A river basin plan can also provide for the operation of dams and weirs to assist the mitigation of pollution events. This would take the form of a pollution mitigation plan describing the responses to pollution events of different types and different levels of severity. Pollution mitigation could occur by dilution or dispersal of pollutants through flow releases, or by withholding flows to prevent dispersal. The appropriate response will depend on the circumstances and will be outlined in the pollution mitigation plan.

Catchment Management

Catchment management seeks to contribute to river basin management by managing the broader landscape to improve water quality of runoff, reduce sedimentation and prevent erosion. Catchment management may also help to manage salinity, groundwater levels, acidification and ecosystem health.

As with all aspects of river basin planning, the first principle is to engage with the community and stakeholders as they have a lot to contribute and the most to gain, or lose, from how the landscape is managed.

Catchment management strategies that contribute to river basin plan objectives can include:

- Integration of Indigenous stakeholders into catchment management;
- Maintaining or restoring an adequate coverage of natural vegetation or deep-rooted perennials, as well as groundcover, to intercept storm runoff, and prevent erosion and sedimentation of river channels;
- Managing groundwater tables and salinity with deep-rooted vegetation and irrigation management;
- Restoring natural vegetation and ecosystems, or blending these with agriculture and urban areas, as part of managing runoff and restoring the linkages between aquatic and terrestrial ecosystems;
- Restoring wetland areas, including their environmental water flow requirements.
- Improving methods of application (or reducing use where possible) of chemical fertilizers and pesticides to prevent pollution; and
- Mine site management to minimise sediment and chemical runoff.

7 Stage 6. Implement — How do we make it happen?

Implementation of water plans and ongoing management

Key actions

- Confirm clear accountabilities, timeframes and governance for plan implementation.
- Develop operational procedures and responses that implement the basin plan.
- River Basin Organisation and/or transboundary governance to coordinate and ensure timely implementation.
- Establish strong independent regulation, firm enforcement and compliance
- Where relevant, develop programs for community-based behavioural change.

Key outcomes

- Clear decision-making process and governance framework is put in place with well-defined responsibilities, adequate resources (budget) and accountability for basin plan implementation and review.
- Engagement with and input from community stakeholders continues.
- Ongoing community programs, regulation, compliance and enforcement to ensure the plan is implemented.

7.1 Rationale

Once established, the river basin plan needs to be implemented. Implementation involves giving effect to the activities and strategies outlined in the river basin plan. How to implement, and to maintain momentum in implementation, is just as important as establishing the plan and necessary institutions. This phase may take place over years or decades depending on the time frame of the plan and periods set for plan revisions.

7.2 Critical considerations

7.2.1 Resourcing, responsibilities and accountabilities for plan implementation

Implementation of the strategies and activities outlined in the river basin plan will involve a wide range of stakeholders. Successful plan implementation requires adequate resourcing, institutional arrangements, accountability and reporting, as well as ongoing engagement with community and stakeholders.

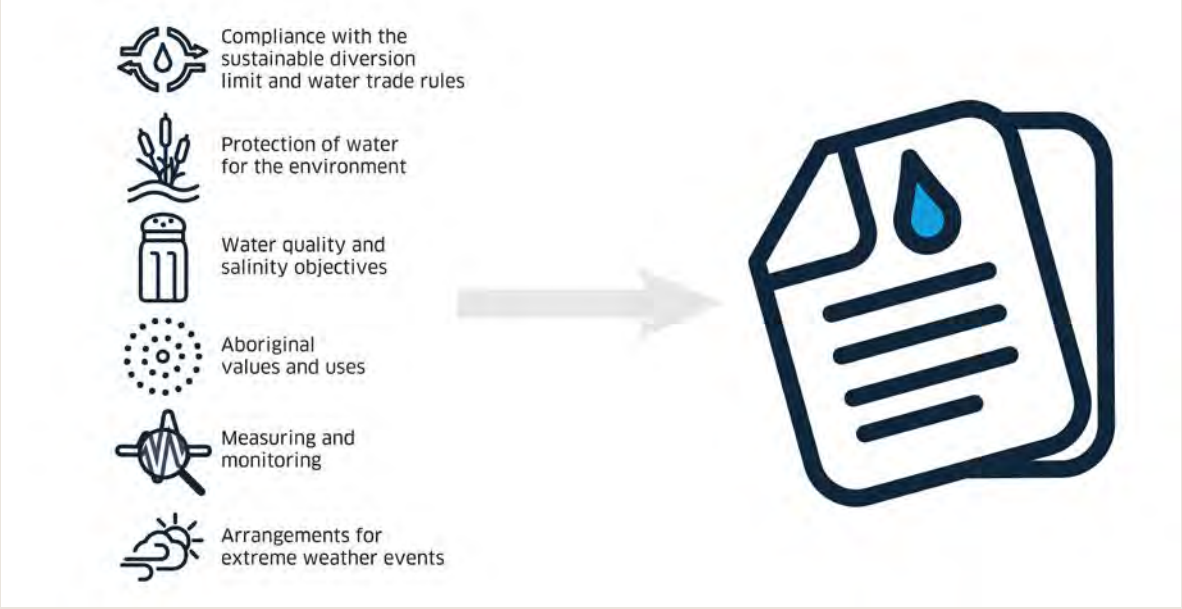
A framework should be established setting out operational responsibilities, budget and accountability for implementation and review. The exact distribution of roles and responsibilities for plan implementation will depend on the specific basin context. This may involve the establishment in legislation of a river basin organisation to provide oversight, and will also require establishment and continuation of cooperative and productive working arrangements between the state/province (or national) water resource management organisations across the river basin.

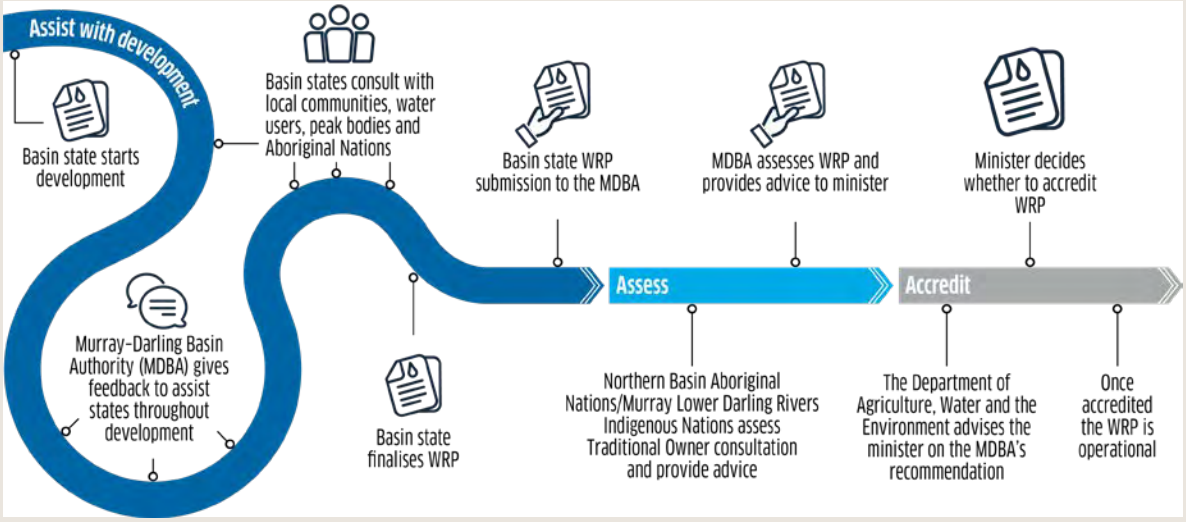
Another important consideration is effective resourcing of Indigenous stakeholders for ongoing meaningful and transparent engagement.

Case study: Implementation of the Murray-Darling Basin Plan in Australia

In the Murray-Darling Basin, the Basin Plan itself (which is national, federal legislation) provides a limited amount of detail on implementation. Instead it requires the development of Water Resources Plans (WRPs). These plans outline how the water resources of a particular area (there are 33 areas across the Basin) will be managed, under state legislation, to be consistent with the Basin Plan including enforcement of the 'sustainable diversion limit' (the extraction limit). This arrangement enables detailed decisions to be made under state legislation at the sub-basin scale, while meeting requirements set for the Basin as a whole. To provide oversight to the WRPs and ensure they are in line with the Basin Plan, each plan must be submitted to the Murray-Darling Basin Authority and accredited by the Federal Minister for Water.

In addition to the state WRPs, implementation requirements, commitments, timeframes and milestones for the Basin Plan are detailed in Intergovernmental Agreements and Implementation Agreements between the National Government, State and Territory Governments and the MDBA. These are published, and progress reports against them are considered periodically by meetings of the Australian Prime Minister and the State and Territory Government Premiers and Chief Ministers (the Council of Australian Governments).





Water resource plan content and accreditation (credit: Murray-Darling Basin Authority)

7.2.2 Regulation, compliance and enforcement

One of the key enablers for implementation is provided by overarching river basin planning legislation and by establishing the basin plan in legislation once it is agreed, including regulatory arrangements to assure compliance in implementation. The specific arrangements for regulation, compliance and enforcement will vary depending on context. For international transboundary basins (and some interstate basins in federal systems), there may not be a mandate or framework for regulatory enforcement, and in this case, the river basin organisation may focus more on joint technical projects or monitoring, audit, evaluation and reporting.

Compliance mechanisms established in river basin planning legislation at national and state/provincial level need to have clear responsibilities and obligations assigned. Responsibility for regulatory compliance and enforcement must be clear and decision making on enforcement may be best allocated to an independent body, separate from political considerations (i.e. independent from national or state government agencies). Enforcement measures need to be seen to be fair, transparent and equitable and proportionate to the significance of the breach of legislation. Clear rules fairly and equitably enforced, underpin a successful water dependent economy and community.

Best practice regulation is fit for purpose – it is contextual and culturally appropriate. It utilises scarce resources effectively and draws on appropriate education and incentives to support water users to comply with a basin plan, while maintaining a clear, independent and unambiguous enforcement of the rules.

According to Ayres and Braithwaite (1992), 'responsive regulation' has been used by many regulators across a range of sectors and countries as a way of managing scarce resources available for enforcement and compliance, and to manage different attitudes towards compliance. This approach takes an increasingly interventionist approach as non-compliance increases. Initially, the model uses cooperative and informative mechanisms to respond to minor non-compliance. Then if someone repeatedly fails to comply with standards, deliberately or wilfully breaks the rules and/or the breach causes a significant impact, they will be classified as being associated with a higher "risk level", and further action will be required, up to prosecution (Figure 9).

Importantly, ongoing education about the rules and how to comply will only work if it is clear that breaking the rules will result in enforcement action. High profile and publicised enforcement on these activities is critical to the success of education and other regulatory and compliance activities. Water is a valuable commodity and without robust and public enforcement with significant penalties for offenders, the incentive to break the rules will remain.

Figure 9. Compliance triangle – illustrating 'responsive regulation'

Note: The broad end of the triangle should be a significant focus of regulatory action. Effort moves towards the narrower end, for a minority of activities that repeatedly, deliberately or wilfully break the rules and/or cause a significant impact. High-profile and publicised enforcement on these activities is critical to the success of education and other activities in the triangle.

Case study: Compliance challenges in Australia, and how they have been addressed

The Murray-Darling Basin Authority sets compliance priorities for each water year (July–June) based on an assessment of the climatic conditions, environmental, economic and social context and a detailed risk assessment of Basin Plan non-compliance for each of the MDBA's key compliance areas, as set out in the MDBA's Compliance and Enforcement Policy (MDBA, 2018).

In 2017, it was revealed through investigation by Australian investigative journalism that there were serious shortcomings in the New South Wales water management compliance and enforcement system. This included revelation of large-scale water users tampering with water meters, and alleged that certain irrigators had pumped water from the river system in periods when pumping was not permitted, or in quantities greatly in excess of their entitlements. Community concern about these compliance shortfalls was high and drove an independent investigation which delivered a report to the NSW Government in late 2017. The investigation was supported by strong and broad-based stakeholder support for firm and quick action to fix the compliance and enforcement system. As a result of the legislation, a new independent Natural Resources Access Regulator was introduced, and individual staff members involved in facilitating the acts of non-compliance were managed through public service processes (NSW Department of Industry, 2017). Further reforms are also underway at the national level to enable broadened regulatory and compliance powers for the MDBA.

Compliance officers in the field (credit: Natural Resources Access Regulator)

7.2.3 The community's role in behavioural change and in tracking compliance

Whilst formal regulation, compliance and enforcement is needed, the community plays a critical role in ensuring appropriate implementation of the plan. Public reporting of issues in plan compliance (e.g. extraction volumes) and an ensuing community response can trigger a review of management and/or institutional arrangements. Community-led change and community-led compliance can play an important role in many local-scale water resources management situations. In larger-scale water resources management, a regulator resourced by, but independent of, government is likely to be required but can still be complemented by community and water user awareness and reporting.

Engaging the Indigenous community can add value in monitoring compliance, particularly in remote and isolated areas of the Basin. Building the capacity of Indigenous Peoples and communities around compliance policy and reporting processes will add value to a river basin plan.

8 Stage 7. Monitor and evaluate — How do we adapt and learn?

Monitoring, evaluation, reporting adaptive management and learning

Key actions

- Establish and implement a monitoring, evaluation, reporting and learning (MERL) framework.
- Monitor compliance by including measuring of water extractions.
- Develop reporting arrangements and undertake reporting.
- Ensure transparency on status of implementation and progress towards outcomes.
- Feedback loops to consider monitoring, evaluation and reporting as an input to reviewing and updating the plan as part of adaptively managing water.

Key outcomes

- The basin plan clearly establishes the timing and focus of formal reviews of its progress and outcomes.
- Measured success of the plan against established targets and performance indicators.
- Monitoring, audit and evaluation triggers action when a part of the plan is found to be underperforming or implementation is lacking.
- Relevant information is available to evaluate progress, report to the community and review the plan.

8.1 Rationale

A key element of successful river basin planning is to establish clear monitoring and evaluation of plan objectives, outcomes and targets. A monitoring, evaluation, reporting and learning (MERL) framework is used to track the implementation and outcomes of the basin plan and should feed back into basin assessments and plan revisions as needed. The framework needs to be an integrated part of river basin planning from initiation onwards. Beginning from when objectives and targets have been identified, basin plan practitioners should ask “how will we know if we are successful?” and “how will this be measured?”

8.2 Critical considerations

8.2.1 Planning is a cycle

Planning is a cyclical, rather than a linear process. The cycle starts with engagement, assessment, then planning, then implementation, then leading to evaluation, reporting, learning and revision to remake or refresh the river basin plan. It is important to consider a river basin evaluation framework at the beginning of the process when developing a vision, objectives and targets that drive clear policy action and clear evaluation. MERL needs to be systematically integrated into implementation, review and decision making, not simply a separate project-based or add-on effort every few years.

Monitoring of compliance, including measuring of water extractions, is a key factor for the successful implementation of a basin plan (discussed in Stage 6). Regular monitoring and assessment against the system needs and extraction limits established by the river basin plan is important both to ensure implementation and accountability, and to provide information for the review of the plan, and to assess the performance of these strategies against the objectives of the plan. This is also an important part of delivering on the engagement and negotiations invested by governments and stakeholders in the development of the plan.

Without monitoring of compliance and monitoring of implementation, it is difficult to be sure if the plan is being implemented consistently, equitably and fairly. This will then likely impact on whether the plan objectives can be achieved and on the level of stakeholder support. For example, metering of larger water users may be required to enable accurate and responsive management of the water resource and to ensure compliance with limits.

Case study: Monitoring, evaluation, reporting and learning in the Murray-Darling Basin

The Murray-Darling Basin Plan includes a chapter outlining a Monitoring and Evaluation Plan.

The chapter outlines the role of the Murray-Darling Basin Authority to report annually on the effectiveness of the Basin Plan and to evaluate the Basin Plan every five years. The chapter also outlines reporting requirements for Basin States, the Commonwealth Environmental Water Holder and the Australian Government Department of Agriculture, Water and the Environment.

The reporting requirements include activity reporting and reporting on monitoring of environmental, social and economic outcomes. These reports provide information to enable the MDBA to undertake its overall evaluations and reports. These activities are coordinated through a Monitoring and Evaluation Working Group involving the MDBA, the Basin States and National Government agencies.

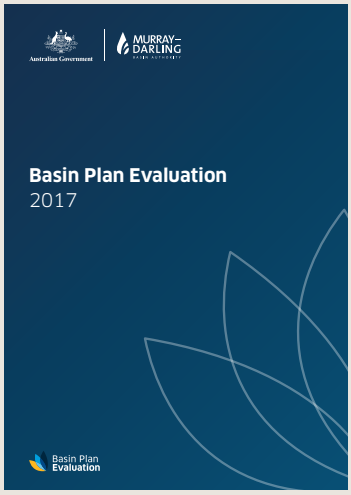
The Basin Plan Monitoring and Evaluation Plan provides a framework and outlines responsibilities, sufficient to provide clarity, transparency and accountability,

From the Basin Plan Annual Report 2017–2018 (MDBA 2018b, p3):

This report brings together progress made by Basin jurisdictions to implement the Basin Plan in 2017–18, and the outcomes from this work. It draws on information in the annual implementation reports prepared by Basin jurisdictions, the MDBA and Commonwealth Environmental Water Office. These reports are provided to the MDBA after the completion of the financial year and are published on the MDBA website.

This Basin Plan Annual Report is a key mechanism through which transparency and accountability for Basin Plan implementation and outcomes is provided, which is especially important given the scale and complexity of this major national reform. Through open and transparent reporting, the goal is to build trust among Basin communities in the agencies responsible for implementation and confidence that the intended outcomes of the reform are being achieved.

In 2017, both the MDBA and the State of Victoria provided evaluation reports of progress towards Basin Plan objectives and targets (MDBA, 2017; Victoria State Government, 2017).



8.2.2 Accountability and transparency in implementation

As outlined in Stage 5, it is critical to provide clarity on responsibilities for implementing the plan. It is equally important to clearly establish responsibility, accountability and timeframes for monitoring and reporting on the implementation of each element of the plan. Requiring all the relevant organisations (state/provincial governments, national government and other organisations responsible for implementation) to publicly report on the progress towards achieving basin plan objectives, provides significant motivation and momentum for MERL as well as implementation. It also provides transparency to stakeholders and the community, as well as confidence to governments. The attribution of responsibilities needs to clearly outline how each organisation is expected to engage with communities and stakeholders.

8.2.3 Data sharing and information management arrangements

During basin plan development, a large amount of data and information will have been collected, including historical hydrometeorological data, modelling results, and ecological, social and economic information. In addition, during plan implementation new datasets and information will be collected including hydrometeorological monitoring, results of plan monitoring and updated climate change projections. Basin planners and other water users in the basin need access to this data to assess the success of the basin plan, or to plan their water use. The plan therefore needs to describe a clear data sharing and data management arrangement to ensure that all relevant data is collected, standardised, reviewed and made available.

Key elements of a data sharing and data management arrangement that need to be described in the plan include:

- Characterisation of data and information collected and being collected;
- Level of confidence in the data;
- Gaps in data;
- Description of the infrastructure adopted to manage the data and information;
- Quality assurance processes;
- Roles and responsibilities for collection, review, storage and accessing data and information;
- Data requirements for implementation, accountability and operational management;
- Data requirements for compliance;
- Capacity development requirements;
- How the data sharing and data management arrangement will be financed;
- Public availability and reporting of data;
- Reporting and evaluation against indicators of plan performance; and
- Data requirements for plan evaluation, learning and review.

Evaluation, learning, review and remaking of the river basin plan

A basin plan should clearly outline the timing and focus of formal reviews of its progress and outcomes. A review could be of the whole plan or of specific elements (e.g. delivery of environmental flows). When a basin plan review or expiry date approaches, the monitoring data relating to the indicators and achievement of the plan objectives needs to be evaluated. A review of the plan needs to be initiated to consider how the plan could be improved to better achieve objectives and the vision. The review then restarts the cycle of plan redevelopment, review of the governance arrangements and implementation.

This process of 'adaptive management' needs to respond to what has been learnt, critically evaluate gaps in implementation or objectives not achieved, as well as respond to changed circumstances (e.g. changed climate, population, industry, water quality and improved science and knowledge about environmental requirements).

Basin communities are often going through profound transitions on a number of scales, driven by complex social, economic, political, technological and environmental factors. Keeping track of how basin planning is influenced by these factors in the wider operating environment is an important element of adaptive management.

Conclusion

With a changing climate and increasing water demands, river basin planning – or other water sharing planning processes – will become increasingly critical for maintaining economic, social, cultural and environmental outcomes in the world's river basins. In response, BasinGuide outlines a process for establishing basin plans and associated governance mechanisms to allocate water resources as well as resolve and manage water disputes to provide a pathway to sustainably, fairly and transparently manage increasingly limited and contested water resources.

BasinGuide provides decision makers a process for developing effective and sustainable basin plans through its seven key stages and guiding questions (summarised below and in Annex A):

1. **Initiate — Why are we doing this and how do we get started?** *Initiation and visioning*;
2. **Ongoing engagement — Who needs to be involved?** *Engaging stakeholders and the community*;
3. **Governance — Who makes decisions and who is responsible for what?** *Enabling governance, policy and legislation*;
4. **Situation assessment — Where are we now?** *Assessing current status and trends for surface and groundwater*,
5. **Plan — How do we plan, consider options and decide strategies?** *Considering options, strategies, trade-offs and decision making*;
6. **Implement — How do we make it happen?** *Implementation of water plans and ongoing management*; and
7. **Monitor and evaluate — How do we adapt and learn?** *Monitoring, evaluation, reporting adaptive management and learning.*

The organisations and people charged with developing and implementing a river basin plan will require a range of skills and capabilities (see Annex B). Technical skills, including engineering and science, will be required to inform the situation assessments, the selection of strategies and the implementation of the river basin plan. However, equally important are skills and capabilities in integration and problem solving across disciplines and information sources. The ability to communicate and engage with a range of non-technical audiences is critical. These audiences will include community and industry representatives, as well as executive and political decision makers. The complex technical information, problems and options for solutions needs to be communicated to these audiences in a manner that allows for co-learning and understanding, as well as in reaching decisions.

The Australian Water Partnership, and the broader Australian water sector, welcomes the opportunity to work with countries in the Indo-Pacific, and beyond, to support them in their own basin planning journeys. In Australia, a broad range of expertise was needed to successfully develop and implement basin and other water resource plans. No single person or organisation can be fully responsible for all parts of the seven stages of the basin plan process. There is therefore a range of individuals and organisations in Australia with the expertise to work with countries in developing and delivering the various aspects of the basin-planning process.

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Annex A: A checklist for river basin planning

Stage	Guiding question	Key actions	Key outcomes
1. Initiate	How do we get started?	• Work with communities and advocacy groups to articulate why basin planning is needed and ensure sufficient consensus to initiate a process. • Initiate the planning process and build a network of support and acceptance of the need for river basin planning. • Seek political leadership and support between all relevant political stakeholders for a basin plan. • Seek to transparently identify and assess the values and objectives of all stakeholders, and engage stakeholders in establishing a basin vision. • Develop long-term objectives with stakeholders, to translate the basin vision into specific aims for the plan to achieve within a specified timeframe and with available resources. • Understand the technical, engagement and communication skills and capabilities of the institutions responsible for basin planning.	• The case for action and the drivers to carry out river basin planning are clear. • Identified the values that each of the stakeholders are looking to protect. • Network of support built for river basin planning. • Basin vision and values developed with community and stakeholders. • Worked with stakeholders to establish long-term objectives that translate a basin vision into specific aims for a plan to achieve, within a specified timeframe and available resources.
2. Ongoing engagement	Who needs to be involved?	• In consultation with stakeholders, map out all stakeholder groups and develop and implement a stakeholder engagement plan including consideration of Indigenous Peoples and Gender Equality, Disability and Social Inclusion (GEDSI). • Consider using a formal representative engagement committee where members consult with their members. • Share all of the available information — don't hide things or trust will be lost. • Seek political leadership and support between all relevant political stakeholders for a basin plan and identify champions. • Seek to transparently identify and assess the values and objectives of all stakeholders, and engage stakeholders in establishing a basin vision. • Understand the technical, engagement and communication skills and capabilities of the institutions responsible for basin planning. • Consider different forms of stakeholder governance — from water user associations, to catchment management groups. • Establish appropriate engagement with Indigenous Peoples.	• Trust built between all parties as well as a shared understanding of key issues. • All relevant stakeholders involved in the planning process, thereby increasing the knowledge base upon which the plan is built. • Built stakeholder and community capacity to participate. • Management of risks that arise from inadequate understanding of community needs and water uses.

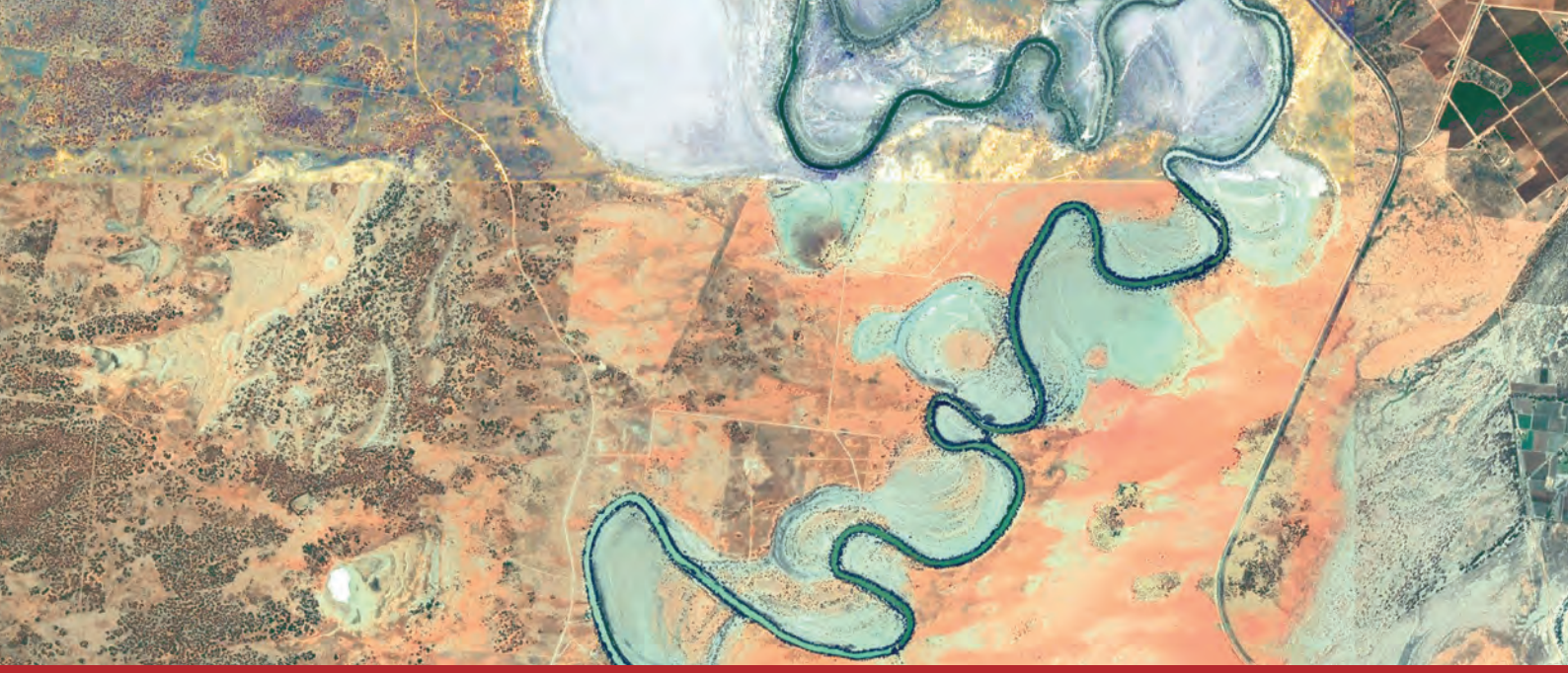
Stage	Guiding question	Key actions	Key outcomes
3. Governance	Who makes decisions and who is responsible for what?	• Establish a legislative basis for the basin plan that articulates the roles and responsibilities of relevant organisations, as well as accountability for the development, implementation, monitoring, evaluation and review of the plan. • Consider separating the basin roles and responsibilities of water resource management, standard setting, service delivery and regulatory enforcement to allow for more effective implementation and transparency of the interaction and trade-offs between these elements of basin management. • Empower a River Basin Organisation (RBO) or similar entity with oversight and/or authority, allowing it to legally engage with other relevant institutions, such as states/provinces, power and water utilities, agricultural industries, fishery representatives and other water users and the community — necessary for the effective development and implementation of the plan. • Establish a dispute resolution process. • Engage Indigenous Peoples interests and knowledge in the decision-making processes.	• Enabling legislation established. • Enabling policy and regulatory framework established. • Institution/s empowered with oversight and/or authority to develop and implement the basin plan. • Clarity on what can be negotiated with stakeholders, what is not negotiable and where stakeholders are asked for input, but decisions rest with governments.
4. Situation assessment	Where are we now?	• Collect social, technological, environmental, economic, policy and legal data and information for the basin. • Determine current and future system needs as well as extractive use needs (surface water and groundwater). • Determine the current and future availability of water. • Develop models using best available science and knowledge that can provide information for decisions and trade-offs in the next stage. • Engage communities in building a common understanding of the basin including identifying issues of common concern. • Develop a process to assess the level of confidence associated with each data set. • Develop a single source of truth that all agree is the baseline — acknowledge where its weaknesses are. • Compile information into a situation, or state of the basin assessment.	• Agreed foundation information and understanding of the basin established in a situation, or state of the basin report including local knowledge. • Process established to actively engage and involve, as well as make information available to, all stakeholders. • Developed basis for hydrological and other computer models that will later be used to assist river basin plan decision making. Ground-truthed with local stakeholders. • Present and future water supply and demands quantified. • Major and agreed issues of common concern identified.

Stage	Guiding question	Key actions	Key outcomes
5. Plan	How do we plan, consider options and decide strategies?	• Determine the content and timespan of the basin plan. • Identify strategies (and alternative options for those strategies) that could contribute to achieving the basin objectives and vision. • Evaluate options against clear and agreed technical, financial, social, ecological, economic and institutional criteria linked to the objectives. • Evaluate the options using a range of sources of information to assess option effectiveness against the objectives, including scientific data, hydrological and other modelling, quantitative and qualitative information, stakeholder engagement, scientific, local and traditional knowledge. • Evaluation of options can use decision support techniques such as multicriteria analysis (MCA), economic cost-benefit or cost-effectiveness analysis, and risk assessment. • Negotiate trade-offs between different water uses, informed by the evaluation information and decision support techniques. • Develop mechanisms to offset or minimise the negative impacts on basin stakeholders. • Decide on the combination of strategies which is likely to best achieve the plan objectives. • For each strategy decided to be included in the basin plan, identify clear responsibilities for implementation and funding. • Integrate selected strategies into a basin plan.	• Basin plan supported by a transparent decision-making process and supporting information. • Basin plan developed, outlining strategies to achieve the agreed basin objectives and vision. • Agreement from stakeholders and relevant governments on the options/strategies outlined in the plan including identification of the trade-offs and who wins/loses, with general support in the broader community. • Mechanisms agreed to compensate stakeholders that are negatively impacted by the plan.

Stage	Guiding question	Key actions	Key outcomes
6. Implement	How do we make it happen?	• Confirm clear accountabilities, timeframes and governance for plan implementation. • Develop operational procedures and responses that implement the basin plan. • River Basin Organisation and/or transboundary governance to coordinate and ensure timely implementation. • Establish strong, independent regulation, firm enforcement and compliance. • Where relevant, develop programs for community-based behavioural change.	• Clear decision-making process and governance framework is put in place with well-defined responsibilities, adequate resources (budget) and accountability for basin plan implementation and review. • Engagement with and input from community stakeholders continues. • Ongoing community programs, regulation, compliance and enforcement to ensure the plan is implemented.
7. Monitor and evaluate	How do we adapt and learn?	• Establish and implement a monitoring, evaluation, reporting and learning (MERL) framework. • Monitor compliance by including measuring of water extractions. • Develop reporting arrangements and undertake reporting. • Ensure transparency on status of implementation and progress towards outcomes. • Feedback loops to consider monitoring, evaluation and reporting as an input to reviewing and updating the plan as part of adaptively managing water.	• The basin plan clearly establishes the timing and focus of formal reviews of its progress and outcomes. • Measured success of the plan against established targets and performance indicators. • Monitoring, audit and evaluation triggers action when a part of the plan is found to be underperforming or implementation is lacking. • Relevant information is available to evaluate progress, report to the community and review the plan.

Annex B: Key skills and capabilities for the seven stages of river basin planning

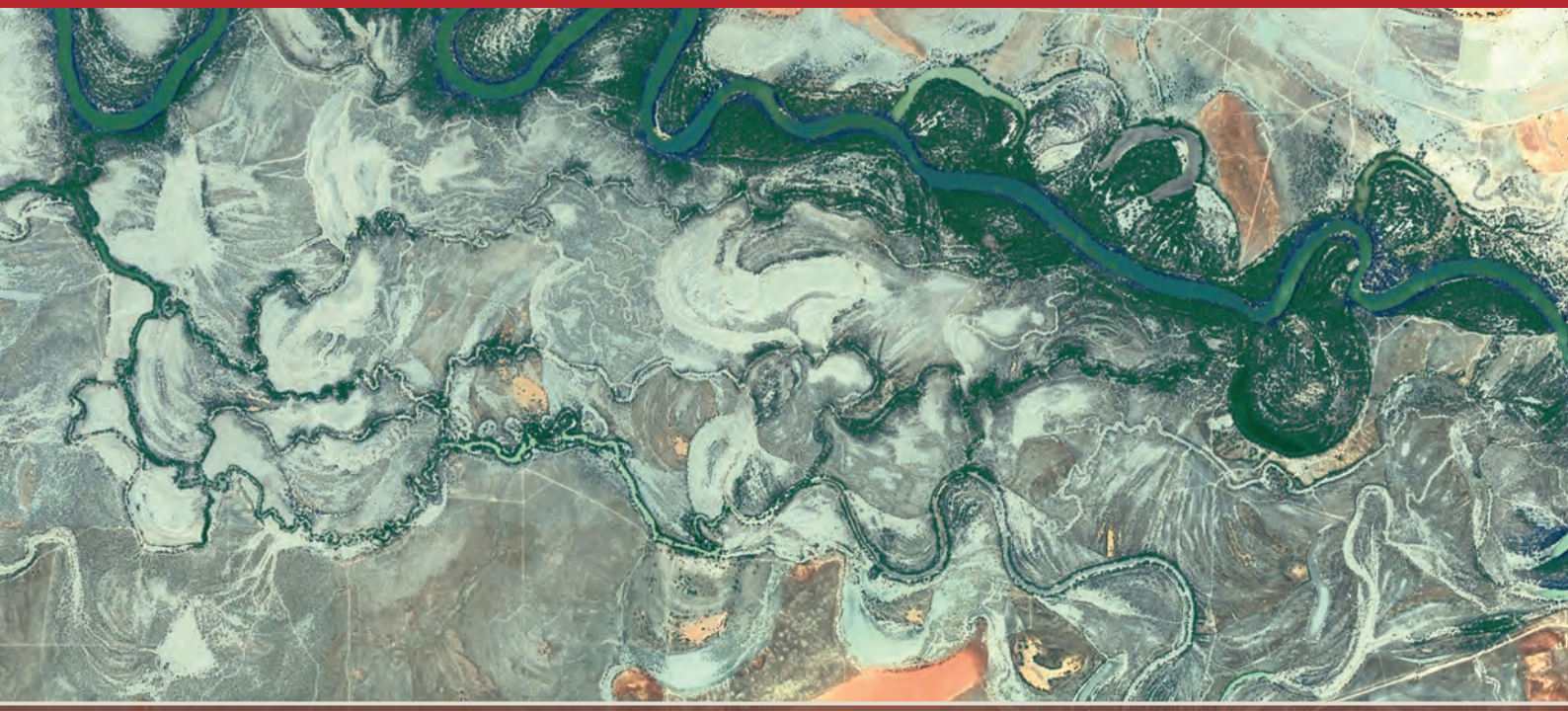
Stage	Stage elements	Skill and capability requirements
1. Initiate	Initiation and visioning	Policy development, building support, stakeholder engagement, communication, listening, facilitation, negotiation, mediation and dispute resolution, leadership, understanding communities and stakeholders, fairness and impartiality, patience.
2. Ongoing engagement	Engaging stakeholders and the community	Stakeholder engagement, communication, listening, facilitation, mediation and dispute resolution, leadership, understanding communities and stakeholders, fairness and impartiality, patience.
3. Governance	Enabling governance, policy and legislation	Policy development, drafting legislation, leadership, mediation and dispute resolution, patience, effective meetings and decision making with multiple parties, accountability for actions, probity and integrity, regulation, compliance.
4. Situation assessment	Assessing current status and trends for surface water and groundwater	Monitoring, data management, analytical skills, spatial analysis, modelling, hydrology, geology and geography, ecology, agriculture, economics, engineering, social sciences, systems thinking, data presentation and visualisation, communication, application of data and information analysis to decision making, stakeholder engagement.
5. Plan	Considering options, strategies, trade-offs and decision making	Leadership, integration and problem solving across disciplines, application of data and information analysis to decision making, stakeholder engagement, listening, communication, negotiation, hydrology, ecology, agriculture, economics, engineering, social sciences, systems thinking, decision frameworks, negotiation, mediation and dispute resolution, fairness and impartiality, patience.
6. Implement	Implementation of river basin plans, ongoing management and compliance	Leadership, mediation and dispute resolution, patience, effective meetings and decision making with multiple parties, accountability for actions, probity and integrity, regulation, compliance.
7. Monitor and evaluate	Monitoring, evaluation, reporting, adaptive management and learning	Monitoring, data management, analytical skills, spatial analysis, modelling, systems thinking, data presentation and visualisation, accountability for actions, communication, application of data and information analysis to decision making, stakeholder engagement, regulation, compliance.



Australia

water partners for development

The Australian Water Partnership is an Australian Government international cooperation initiative helping developing countries in the Indo-Pacific region, and beyond, work towards the sustainable management of their water resources.



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