Chapter 16: Challenges to Improved Integrated Management of the Murray-Darling Basin

Citation: Rebecca Nelson, "Challenges to Improved Integrated Management of the Murray-Darling Basin" in Barry Hart, Nick Bond, Neil Byron, Carmel Pollino and Mike Stewardson (eds), *The Murray-Darling River System: Its Future Management from Catchment to Coast* (Elsevier, 2021) 339-362, https://doi.org/10.1016/B978-0-12-818152-2.00016-4

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Abstract

This Chapter discusses the legal and policy challenges in a Commonwealth-lead strengthening of the integrated management of natural resources (water, land and biodiversity) in the Murray-Darling Basin (MDB). With the introduction of the Commonwealth Water Act in 2007 and the Murray-Darling Basin Plan in 2012, previous Commonwealth initiatives focused on the cooperative management of the Basin's natural resources were diminished through an emphasis on water quantity and over-allocation. A case is made for greater Commonwealth involvement in better integrating land and water management in the MDB, including a consideration of the value of pursuing an approach that recognises cumulative environmental changes. The existing governance foundations, particularly in the Water Act and MDB Agreement, for more integrated approaches are discussed. A number of options for improving integrated management in the MDB are provided, considering different levels of ambition and based on different legal mechanisms, which would involve a range of roles for the Commonwealth government.

Keywords: Water Act, Basin Plan, integrated catchment management, cumulative effects, greater Commonwealth government involvement, legal and policy options.

Introduction

Integrating the consideration of interconnected elements of the environment - for present purposes, water, land and biodiversity - is axiomatically better for sustainability than approaching single issues in isolation. However, since its heyday during the 1990s and early 2000s, coordinated inter-jurisdictional action on integrating consideration of these environmental elements in the Murray-Darling Basin (MDB) has faded in favour of a stronger emphasis on managing water quantity and over-allocation. Yet developments in knowledge about land use and biodiversity and new problems in these areas demonstrate challenges to ensuring and optimising the benefits of the current approach to restoring the health of the MDB, centred on environmental flows, without integration. These developments and problems also encourage a new focus on cumulative environmental effects and incremental environmental change, concepts that can helpfully focus efforts to manage catchments in an integrated way by emphasising how different stressors interact and aggregate over time and space.

Key elements of current MDB governance arrangements already provide the foundations for an improved approach to integrating biophysical aspects of catchment management (hereafter termed 'integrated management'), guided by cumulative effects thinking. This chapter argues that greater Commonwealth government involvement in integrated management would optimise and secure the environmental outcomes sought under current Commonwealth-led arrangements. More integrated management would re-engage with the central purpose of the Intergovernmental MDB Agreement (IGMDA, 2008), first expressed three decades ago, and continuing in substantially similar terms today, namely: 'to promote and co-ordinate effective planning and management for the equitable, efficient and sustainable use of the water, land and environmental resources of the Murray-Darling Basin' (*Water Act 2007* (Commonwealth), Sch 1 cl 1).

The key focus of this Chapter is to evaluate high-level options for law and policy reforms to pursue greater integrated management of the biophysical environmental elements of the MDB (water, land and biodiversity) using existing law and policy foundations and inspiration from recent developments in other jurisdictional contexts. Wider literature on integrated catchment management, integrated water resources management, integrated river basin management, and numerous other variants, also speak to wider, interconnected issues under the banner of a broader view of 'integration', including issues of stakeholder engagement, power dynamics and institutional complexity and coordination (e.g. Bouckaert et al., 2018: Garrick et al., 2012; Wallis and Ison, 2011). While these broader issues lie beyond the scope of this Chapter, they will be relevant to selecting appropriate reform options, which are here presented as a range of options for future consideration, alongside these broader social issues, and no doubt many others.

Formal law and policy are but one piece of this puzzle, though one that this Chapter suggests could act as a foundation for other elements. Conversely, addressing or at least being cognisant of the current law and policy constraints discussed here, may be a prerequisite to better implementing biophysically integrated management. At the same time, it must be acknowledged that any reform effort featuring a deeper Commonwealth role will likely be subject to political limitations and funding challenges, particularly any role that builds on the politically fragile Basin Plan.

The second part of this Chapter outlines the case for better integrating the water, land

and biodiversity elements of the MDB with reference to biophysical evidence of environmental challenges, the value of pursuing an approach that recognises cumulative environmental effects (seeking to make novel theoretical connections between integrated management and the management of cumulative environmental effects in a legal context), and policy justifications for greater Commonwealth involvement in this form of integration.

The Chapter then explores existing governance foundations for more integrated approaches, focusing on key concepts and legal mechanisms under the Commonwealth Water Act and MDB Agreement. It offers three options for deepening integrated management in the MDB at different levels of ambition and based on different (Basin Plan and non-Basin Plan) legal mechanisms, which would involve a range of Commonwealth roles.

The fourth part of this Chapter then discusses a case study of a recent Australian effort to better integrate land, water and biodiversity in the catchment of the Yarra River, Victoria, highlighting how it responds to key MDB concerns and includes important components of an integrated approach that recognises cumulative environmental change. The Chapter concludes by reflecting on vehicles for change that emerge from past and present MDB arrangements and inspiration from the comparative case study.

The case for better Commonwealth-level integrated management

Biophysical and cultural evidence

The ecological and social condition of the MDB is rarely far from the front of Australia's national consciousness. From 2014 to 2018, Commonwealth and state parliaments and government agencies investigated various aspects of MDB governance on at least eight separate occasions, for a variety of planned and unplanned reasons. An important focus of recent concern has been how effectively current MDB arrangements deal with catchment activities that directly impact water quantity and flows. Activities like floodplain harvesting, groundwater extraction and other floodplain developments historically have not featured strongly in river-focused MDB arrangements because they are closely connected with land use and individual state responsibilities. The influence of these activities is now being increasingly recognised through a variety of mechanisms discussed in this Chapter.

Catchment activities can fundamentally affect water quantity, its quality and the condition of water-related ecosystems. A recent Commonwealth parliamentary inquiry noted the 'economic, social, physiological and physical health' implications of low and dry flow conditions, and also highlighted the cumulative significance for river flows of collecting, impounding, and using overland flood flows using floodplain earthworks (Senate Committee, 2018). Additionally, a recent South Australian Royal Commission referred to floodplain harvesting as 'a virtually data-free zone' in relation to measurement of diversions (Walker, 2019, 34; see also Grafton, 2019). It also reserved special criticism for the current treatment of groundwater withdrawals, which entered cooperative MDB arrangements only in 2007, extending an almost century-long focus on surface waters. The Commissioner noted that state groundwater management historically had been inadequate, and that 'unacceptable' levels of scientific uncertainty and a failure to appropriately consider connectivity between groundwater and surface water persisted (Walker, 2019, 67).

The impacts of both farm dams and groundwater pumping have been the subject of concern for many years in the MDB (e.g. Earth Tech, 2003). The Royal Commission also highlighted slow progress in removing 'the physical, operational and management constraints that are affecting or have the potential to affect environmental water delivery' (Walker, 2019, 349), including negotiating legal agreements with floodplain landholders to enable their land to be flooded by environmental flows. Conversely, the Commissioner also concluded that delivering environmental water in an 'unconstrained' context would achieve wider benefits outside the river channel, including flushing salt from the landscape, and watering floodplain wetlands and forests (Walker, 2019, 357).

Pollution and water quality problems also affect rivers and are inherently land use problems. Diffuse water quality concerns first crystallised in the MDB at a Commonwealth convened meeting to address salinity problems experienced by South Australia. Following this was a newly drafted MDB Agreement that included research and monitoring of water quality in its scope (Walker, 2019, 84). Later intergovernmental arrangements established jointly funded infrastructure to intercept saline groundwater before it discharged to the River Murray (Water Act, Sch 1 & B). These arrangements continue to operate.

Governments have been reticent to regulate nonpoint source water pollution more broadly, despite some progress with water quality offset schemes and infrastructure-based solutions such as retarding basins to treat runoff (Nelson, 2011; Waschka and Gardner, 2016). This issue is now achieving greater prominence, as an Australian Academy of Science report on the mass fish kills experienced in late 2018 and early 2019 in the Darling River recommended additional monitoring to better understand the role of nutrient-laden agricultural runoff and manure deposited by stock accessing streams (Moritz et al., 2019).

Globally, recent scientific research on the emerging threats facing freshwater biodiversity include many that lie outside the traditional realm of problems amenable to river management that is solely focused on water quantity or quality. These threats span boundaries and issues, being either catchment-based or global, including climate change; invasive fish and weed species spread through e-commerce; and emerging contaminants such as microplastics and active pharmaceutical ingredients (Reid et al., 2018). Moreover, freshwaters are affected by 'cumulative stressors' or multi-stressor impacts. Understanding these interactions is vital to manage these impacts, since taking action to deal with a dominant stressor 'might simply reveal the effects of lessor stressors without any biodiversity gain' (Reid et al., 2018). This points to the value of considering interactions between cumulative effects (see below) to determine the extent to which land use and biodiversity stressors pose critical risks to statutory environmental objectives.

Beyond direct biophysical reasons for integrating water, land and biodiversity, there is growing governmental and public recognition of the importance of acknowledging and facilitating the achievement of Indigenous objectives for water management. These issues also inherently span jurisdictional boundaries and biophysical issues since Indigenous nations are not arranged in space in a way that aligns with settler state boundaries (Weir, 2009). Aboriginal people may hold traditional obligations relating to water and other resources that include ensuring, for example, that water flows across Country from one community to another in a way that crosses state boundaries (Nelson et al., 2018). Moreover, Indigenous people tend to view landscapes more

holistically than do settler laws and institutional structures. For example, the Echuca Declaration Part I, Article 2 (ii)) stated 'The land, water and people are one' (MILDRIN, 2007). This holistic view can also extend to land and seascapes (Barber and Jackson, 2015). Current approaches to Indigenous objectives include some recognition in the Basin Plan, modest efforts to achieve Indigenous objectives with environmental water (necessarily limited by the statutory objectives that apply to this water), and efforts to purchase small water entitlements for Indigenous purposes, which recent research indicates has significant public support (Jackson et al., 2019; see also Chapter 15 of this book).

Water quantity, quality, aquatic biodiversity and cultural needs face longstanding, on-going and emerging threats that go beyond the focus and strengths of traditional water management, and often take the form of cumulative stressors. Addressing such threats is likely to require more coordinated consideration of water, land and biodiversity management in the MDB, and may benefit from clearer attention to their cumulative nature. Restoring appropriate environmental flows in the MDB is central to its restoration under the Basin Plan. However, doing so may not result in lasting environmental goals without complementary actions that recognise the integrated nature of catchment resources.

Integration and cumulative effects in the MDB

Before reviewing arguments for greater Commonwealth involvement in integrating water, land and biodiversity in the MDB, this Section briefly introduces two perspectives to guide subsequent discussion of the desirable content of this involvement. The first is a discussion of key concepts of integrated catchment management (ICM), recapping Chapter 9 of this book, and briefly introducing the historical adoption of ICM policies in the MDB. The second is the concept of cumulative environmental effects or changes, with which the ICM literature is yet to draw strong links, but which underscores some typically under-emphasised aspects of integrated management.

Overview of water-land-biodiversity integration in catchment management

Integrated management of water, land and biodiversity is a long-standing tenet of water management under a variety of conceptual banners. Integrated water resources management (IWRM), ICM and other related concepts originally emerged in thinking in the United States in the early twentieth century and became prominent internationally in the 1990s (Molle, 2009; Gallego-Ayala, 2013; Benson et al., 2015).

While there is no universal agreement on the content of these various theories, there are common elements, including: integrating water policy and other policy sectors, typically in a water-centric way; coordinated, multi-level institutional responses that ensure transparent and collaborative decision-making, premised on management at the river basin scale; efficient resource use; and sustainable development (Benson et al., 2015). Riddiford (Chapter 9) further elaborates key normative principles, and suggests that several desirable characteristics of ICM have been under-emphasised in Australia to date, and are vital to integrated consideration of the biophysical elements of catchments. These include:

- Tackling issues in a genuinely integrated way, that is, dealing with the interactions between natural resources issues, rather than addressing multiple single issues like weeds, feral species, vegetation or salinity
- Achieving consistency between regional approaches, while respecting regional

differences

- Ensuring that voluntary and incentive-based approaches are complimented by statutory powers
- Undertaking sufficient 'systematic, state-wide monitoring and evaluation of the condition of the resources'
- Securing long-term funding arrangements.

While most scholarship on ICM has arisen in the natural and social sciences, legal scholars and legislators have also recognised that institutional, law and policy vehicles are required to facilitate the kinds of integration that are central to ICM, and that establishing and implementing these vehicles is challenging (e.g. Nelson, 2005; Perko, 2012; Matthews, 2014; Lavrysen, 2017; Howarth, 2018). Consistent with Riddiford's observations about statutory powers to implement ICM, this Chapter emphasises the role of statutory vehicles in integrated management arrangements.

Pursuing inter-jurisdictional integrated management is not new in the MDB. For example, a MDB Natural Resources Management Strategy (discussed further below) emerged in 1990, then transformed in 2001 into an ICM policy in response to salinity concerns (MDBMC, 2001a). This ICM policy was directed broadly to the 'natural resources' of the MDB and recognised that it required 'a whole-of-catchment approach, one that takes account of the relationships between natural systems, including land, water and other environmental resources'. Also, it provided for catchment-level targets that aimed to integrate 'traditional' water sharing targets with water quality, riverine ecosystem health and, perhaps most surprisingly, terrestrial biodiversity targets. Crucially, these catchment health targets were used as proxy 'agreed … *limits* to the stresses which can be placed on the Basin's natural resources' (MDBMC, 2001a, emphasis added). However, these efforts were 'quickly sidelined' and not supported by sufficient funds (Walker, 2019, 88).

It is worth remembering the broad biophysical scope of this approach - accepted as appropriate to an intergovernmental context in which the Commonwealth government played a key role, in the cooperative federalism paradigm - in light of the narrower scope of the Commonwealth *Water Act 2007*, discussed below. It is also worth noting the conceptual similarity between the idea of a natural resources target as a limit to stress, and the more overt 'sustainable diversion limits' used in the Water Act. At the same time, the failure to implement the 2001 ICM policy in the MDB underscores the potential practical and political difficulties that the Commonwealth would face in attempting a meaningful, cooperative, and adequately funded approach to integrated management in the MDB.

The value of cumulative effects concepts

Discussions of integrated management of the MDB often draw from ICM and other 'holistic, integrated, joined-up, cross-sectoral, ecosystem-based and polycentric approaches' (Larson et al., 2018). Here it is argued that work on cumulative environmental effects and cumulative environmental change highlights critical, but sometimes under-emphasised, features desirable for integrated management in the MDB. Cumulative effects are less commonly discussed in the catchment context in Australia, although they are much discussed in Canadian watersheds (Dubé et al., 2012; Dubé, 2003; Noble and Basnet, 2015).

Cumulative environmental effects can broadly be conceived as 'the phenomenon of

temporal and spatial accumulation of change in environmental systems in an additive or interactive manner' (Spaling and Smit, 1993). Assessing and managing cumulative effects is a 'correlate to regional or comprehensive planning' (Spaling and Smit, 1993), or more strongly, 'inseparably' linked with planning processes that seek to allocate resources (Jones, 2016). In addition to emphasising interactions between environmental elements, focusing on cumulative environmental effects (comprehensively summarised in Jones, 2016) also emphasises the following matters of particular relevance to biophysical integration in the MDB:

- *Consideration of the effects of natural and anthropogenic sources of environmental stress* (Dubé et al., 2012) across all relevant resources of the catchment, including land uses (Noble and Basnet, 2015), some of which may be individually minor but may aggregate in a collectively significant way. For example, in the MDB context, these effects may include large-scale natural variation in rainfall as well as numerous individually minor activities like farm dam construction
- *A broad spatial and temporal scope*, including considering the ongoing past effects of activities and the reasonably foreseeable future effects of multiple activities, investigating how effects interact across space, including across boundaries (Spaling and Smit, 1993). Again, in the MDB context, this may include drawing attention to reducing water allocations in overallocated systems to meet environmental objectives, rather than necessarily accepting current levels of diversion, and considering foreseeable climate change impacts and the yet-to-be manifested impacts of past and present groundwater developments on river flows
- *The importance of data and knowledge* in assessing cumulative change (Dubé et al., 2012; Nelson, 2019), with strong support for a central, integrated data repository maintained by a scientific authority in multi-jurisdictional settings (Dubé 2003). In the MDB context, the importance of centralised data relates not just to water availability and quality, but also stressors like land use change, other drivers of biodiversity change, and forecasted future changes to these stressors
- *Resource-based limits and thresholds* (Johnson, 2013; Jones, 2016), which relate to sustainable diversion limits and natural resources limits contemplated by the 2001 ICM Policy (MDBMC, 2001a) in the MDB context.

These cumulative effects principles underscore aspects of integrating biophysical resources that are present, but arguably have been under-emphasised, in debates about the sustainability of the MDB. These principles serve three key functions. First, they offer theoretical support for the biophysical evidence adduced in support of integrated management; second, they point to advantages of a Commonwealth approach; and third, they offer principles for evaluating current and potential future legal arrangements for integrated management.

Case for greater Commonwealth government involvement in integrating natural resource management in the MDB

Greater Commonwealth government involvement carries distinct advantages and disadvantages in addressing the lack of integration of natural resources management across water, land and biodiversity in the MDB. Applying cumulative effects principles generally supports a Commonwealth role that is greater than is presently expressed in the Water Act, although as suggested below, this role might take a wide range of forms, and should not be understood as an argument for the Commonwealth to 'go it alone'.

Objectives and threats span state boundaries

Water in the MDB flows across state boundaries. Ecological assets and threats also span these boundaries, as may Indigenous cultural objectives for water (see above). Emerging problems, such as climate change and pest plants and animals, equally span jurisdictional boundaries. It therefore follows that water and connected resources would benefit from management through institutions, coordination or collaboration at the supra-state scale, and across jurisdictional boundaries. At a minimum, such a situation would ensure that one jurisdiction's actions do not counteract those of another (Young, 2002; Davidson and de Loë, 2014). The Commonwealth has a role in many supra-state and state-spanning matters (*Australian Constitution*, s 51(i), (xiii), (xiv), (xxxv)). This is not to say that a Commonwealth role in legislating for these matters is always justified or uncontroversial, but that *some* role is clearly justified, and indeed evident in the past century of Commonwealth involvement in natural resources management.

Threats to Commonwealth legislative objectives

Catchment activities affect key Commonwealth policies and mechanisms, including: ensuring an environmentally sustainable level of take of water from the MDB, effectively using environmental water entitlements held by the Commonwealth Environmental Water Holder (CEWH) (see Chapter 10 this book), and protecting threatened species, including aquatic species, listed under the *Environment Protection and Biodiversity Conservation Act 1999* (Cth) (EPBC Act, 1999). The benefits of the Commonwealth's multi-billion-dollar investment in buying back water and modernising irrigation infrastructure may be threatened by catchment activities that constrain the delivery of environmental water (Water Act, s 86AA(3)(a)), such as building on floodplains unconstrained by state land use laws. Catchment activities may also compromise the Commonwealth's effectiveness in achieving environmental outcomes if water quality is poor, as might occur where land use activities contribute to high non-point source water pollution. In some cases, proactive non-quantity-related activities might be necessary to make environmental flows effective, that is to achieve statutory objectives to 'protect and restore the wetlands and other environmental assets of the [MDB]' and 'protect biodiversity dependent on the Basin water resources and achieve other environmental outcomes for the [MDB]' (Water Act, s 28(1)(d), (e)).

Two geographically diverse examples illustrate interactions that require integrated management. Waterbird populations have 'plummeted' in the internationally protected Coorong wetlands (see further Chapter 5 this book), which ultimately receive improved environmental flows. However, part of this population decline is due to disappearing aquatic grasses (Brookes et al., 2009). Recovering waterbird populations will require not only providing more water, but also addressing low seed banks of these grasses (Brookes et al., 2009). Further upstream, highly mobile feral pigs threaten wetlands, river systems and at least 155 EPBC-listed species and ecological communities, including numerous aquatic species (DEE, 2017). Under the EPBC Act, feral pigs constitute a 'key threatening process' that is recognised to require integrated action in land management activities at all levels, and coordination between these activities (DEE, 2017). Both examples demonstrate how an integrated approach to land, water and biodiversity is required to meet both existing Commonwealth water and also ecological objectives.

Australia's international obligations

A greater Commonwealth role in driving the integrated management of resources in

the MDB would seem to be in line with discharging its international treaty obligations. A key objective of the Commonwealth Water Act and the Basin Plan is to give effect to international agreements (Water Act, ss 3(b), 20(a), 21(1)). Expanding Commonwealth legislation from its current focus would require careful consideration of constitutional matters and established policy on dividing environmental powers in Australia (Gardner et al., 2017).

This Chapter cannot fully discuss the potential legal avenues for an expansion in the Commonwealth's legislative focus to more integrated management, nor does it argue that legislative reform is required to encompass greater Commonwealth involvement. However, it is worth noting that the international agreements that form an important foundation for the constitutional legitimacy of the Water Act (Gardner et al., 2017) also support managing land, water and biodiversity in an integrated way.

The Conference of the Parties under the *Biodiversity Convention* has adopted an 'ecosystem approach', being 'a strategy for the *integrated management of land, water and living resources* that promotes conservation and sustainable use in an equitable way', which particularly informed the Water Act's concept of an 'ecologically sustainable level of take' (Walker, 2019, 136). Additionally, the *Convention on Wetlands of International Importance* (commonly called the Ramsar Convention, 1971) requires the contracting parties to 'formulate and implement their planning so as to promote… as far as possible the *wise use* of wetlands in their territory' (art 3.1, emphasis added). The Conference of the Parties defines the concept of 'wise use' as 'the maintenance of [the wetlands'] ecological character, achieved through the implementation of *ecosystem approaches*…' (Ramsar Convention, 1971, COP 9, Resolution IX.1, Annex A, emphasis added).

The ecosystem approach is also mentioned and adopted in a variety of other international agreements to which Australia is a party, and which the Commonwealth cites as the constitutional basis for environmental legislation, including the *Convention on International Trade in Endangered Species of Wild Fauna and Flora* and the *Convention on Migratory Species* (Platjouw, 2016).

Accountability

From its position above state politics, the Commonwealth has the potential to keep states accountable for environmental outcomes, particularly in cases where states may receive short-term economic benefits from activities that involve environmental risks. Public concerns about the deficiencies of state management of coal seam gas developments recently contributed to Commonwealth protections for water resources affected by these projects (Hunter, 2017). Additionally, ongoing public concern about state enforcement of water laws has triggered proposals for a new Commonwealth entity, the 'Basin Plan Regulator', to escalate and enforce non-compliance with limits on water 'take' (Senate Committee, 2018). Concerns about the effectiveness of state catchment management regimes (e.g. Victorian Auditor-General, 2014) might equally be addressed, at least in part, by greater Commonwealth oversight. If such oversight were accompanied by Commonwealth funding (similar to past funding of programs like the Natural Heritage Trust and National Action Plan for Salinity and Water Quality), this would raise additional issues: Commonwealth financial support of state delivery of catchment management functions would risk encouraging states to cut their own funding to these functions, a risk foreshadowed by Commonwealth-state bickering about joint program funding under the Basin Plan (Guest, 2017). At the same time, Commonwealth financial assistance has undoubtedly prompted cooperative action in

the MDB that might not otherwise have occurred (Guest, 2017).

Community concerns about water governance

There is currently considerable community concern about water governance in the MDB. These concerns include that the Commonwealth is too far removed from the local communities that manage the land, and that it lacks relationships with these communities and an understanding of the issues that affect them (Alston et al., 2016; Agrawal and Gibson, 1999).

Stronger Commonwealth involvement in better connecting land, water and communities may counteract these criticisms through better recognition of the whole social-ecological context of the MDB (Alston et al., 2016, 61), particularly if its greater role in integrated management supported information flows between different levels of governance and spatial scales in pursuit of greater transparency about management (Horne and O'Donnell, 2014; Alexandra, 2019). In analysing stakeholder concerns about the Basin Plan, Alston et al. (2016) concluded that '[i]ronically, greater collaboration also requires a much stronger, more definitive position on the part of the Commonwealth to enunciate water reform priorities and a shared vision' and 'may require the Commonwealth to move to a more broad-ranging territorial focus'. Perhaps counter-intuitively, more integrated management through an expanded Commonwealth role could help address key stakeholder concerns about the Commonwealth's authority and legitimacy in the MDB.

Ultimately, the matter of public support may be critical to the political palatability of reform options and state-federal cooperation more generally. In reviewing a century of MDB governance, Marshall et al. (2013, 238) concluded that '[i]n practice, the central factor in defining the extent or limits of government capacity to implement reforms that promote IWRM is not the nature of the legal powers available (which in principle are strong) but rather the state of public opinion'.

Existing foundations of a better integrated approach in the MDB

If the Commonwealth government were to assume a greater role in integrating land, water and biodiversity management in the MDB, it could do so in a number of ways, which should be informed by an analysis of its existing powers. Key elements of the MDB Agreement (Water Act, Sch 1) and the Basin Plan 2012 provide a foundation for improving integrated management. They enable, and in some cases arguably require, a broad focus on water, land use and biodiversity in catchments, rather than a narrow focus on just water quantity and quality management. They also inherently draw attention to the importance of cumulative effects. These foundations take shape, first, through key statutory concepts, and second, through specific legal mechanisms. Both highlight that although public debate has tended to focus almost exclusively on water quantity issues, existing law and policy suggest a more integrated picture for the management of the MDB.

Integrated management in key statutory concepts

Existing MDB arrangements see water as more than liquid H_2O in isolation from its surroundings. They encompass a more realistic view of the activities and environmental components to which water is connected. This is evident in the foundational terms 'take' and 'water resource', operationalised in the Basin Plan, which is expressly intended to 'provide for the integrated management of the Basin water

resources', particularly through limits on the 'take' of Basin water resources (Water Act, s 20).

The key concept of 'take' in the Water Act is very broadly defined to mean 'to remove water from, or to reduce the flow of water in or into, [a] water resource', which includes not only traditional methods of removing water from an aquifer or stream using a pump, but also for example, 'stopping, impeding or diverting the flow of water in or into the water resource' (Water Act, s 4(1)). This definition includes land uses like forestry, which remove water using trees; catchment dams, which reduce the flow of water into streams; and the existence of mine voids that intersect the water table, into which groundwater discharges. It inherently integrates and recognises interactions between water and land use.

Likewise, the definition of 'water resource' links water, land and ecosystems. It defines 'water resource' as '(a) surface water or ground water; or (b) a watercourse, lake, wetland or aquifer (whether or not it currently has water in it); and includes all aspects of the water resource (including water, organisms and other components and ecosystems that contribute to the physical state and environmental value of the water resource)' (Water Act, s 4(1)). Generally, wherever the Water Act mentions water resources, it means this broad, inherently integrated view of the term, which also includes current and future risks to the condition of 'water resources' (Basin Plan, cl 10.41).

A central element of the Basin Plan is the concept of 'sustainable diversion limits' (SDLs), which must reflect an 'environmentally sustainable level of take' (Water Act, s 21(1)). Limits on take from a water resource are set having regard to, among other things, the key 'environmental assets' of the water resource and key 'environmental outcomes' (Water Act, ss 4(1), 23(1)). These terms are defined, respectively, to include 'water-dependent ecosystems'; and 'ecosystem functions' and 'water resource health' (Water Act, s 4(1)). These terms, in turn, directly reference activities that are inherently or likely land-based, like 'maintaining ecosystem function by the periodic flooding of floodplain wetlands' and 'mitigating pollution and limiting noxious algal blooms'.

Considering these above terms together, it is clear that they facilitate linking water, land and biodiversity, and also that they reflect key tenets of thinking on cumulative environmental effects. The key stressors encompassed by the definition of take are individually minor, but collectively are significant activities, some of which traditionally have been unregulated. The Basin Plan deals with stressors that 'take' water using an aggregate resource-based indicator (SDLs), which links to ecological concerns.

Integrated management in legal mechanisms

The Water Act, Basin Plan and MDB Agreement include legal mechanisms that promote the integration of water, land and biodiversity, particularly by engaging with land-based activities on floodplains and wider catchments. However, in some cases, these mechanisms suffer from significant statutory constraints to their potential to deliver integrated management. Such constraints include: the narrow scope of strategies to manage risks to water resources; plans to manage environmental water; plans dealing with water quality; and restrictions on the ability to flood riparian land. They contrast markedly with the breadth of the statutory concepts discussed above.

Controlling interception activities (integrating water and land)

SDLs cover water taken through activities that are more generally considered to be

land use activities due to the wide definition of 'take' outlined above. This is clearest in relation to 'interception activities', which are activities that intercept 'surface water or ground water that would otherwise flow, directly or indirectly, into a watercourse, lake, wetland, aquifer, dam or reservoir' (Water Act, s 4(1)). Limits on take therefore encompass water taken by catchment dams, forestry plantations, mining activities, and floodplain harvesting (Basin Plan, cl 10.23). The Basin Plan also contains some limits specific to certain kinds of interception activities, for example, stock and domestic uses, runoff dams, and commercial plantations (Basin Plan, cl 10.13). It also specifically requires state-formulated water resources plans to monitor and identify actions to be taken in relation to interception activities that may have an individually or cumulatively significant impact on Basin water resources (Basin Plan, cll 10.23-10.25). This closely mirrors cumulative effects thinking about the significance of many individually minor activities.

It is too early to judge the extent to which, and how, states apply and enforce these provisions. At the time of writing (February 2020), only 8 of 33 water resource plans have been accredited, with another 5 undergoing review, and a further 20 WRPs from NSW yet to be submitted in final form (MDBA, 2019). Additionally, the way that farm-based interceptions were used in the MDBA's calculation of limits on take has undergone change and criticism (Grafton, 2019). Clearly, however, controlling aggregate 'take' by land-based activities is important to the environmental sustainability of the Basin water resources.

Understanding risks to water resources (integrating water, land and biodiversity)

An important justification for Commonwealth action to integrate management in the MDB is to respond to risks that non-water issues pose to Commonwealth objectives, and to optimise the benefits of Commonwealth water policies and investments. The Water Act does this in a limited way by requiring the Basin Plan to identify 'the risks to the condition, or continued availability, of the Basin water resources', extending beyond 'the taking and use of water', to include 'the effects of climate change', 'changes to land use', and limitations to knowledge about Basin water resources (Water Act, s 22(1)). The Basin Plan is also required to set out the strategies to be adopted in managing or addressing these risks. This effectively constitutes considering 'reasonably foreseeable future effects of multiple activities' in cumulative effects terms, although the adequacy of the strategies set out in the Basin Plan has been questioned (Walker, 2019).

The Basin Plan itself tends to take a fairly narrow view of 'water resources', de-emphasising biodiversity aspects in favour of a water quantity focus. It does not, therefore, address the broader risks to the ecosystems that contribute to the environmental value of the water resource, as per the definition of the concept. The strategies focus on the affected water resource rather than the non-water stressor by requiring that strategies for addressing risks 'must relate to the management of Basin water resources' (Water Act, s 22(1)). In other words, the Basin Plan may not seek to manage risks related to land use and biodiversity posed to water resources by directly addressing land use changes or non-water-related activities that cause aquatic biodiversity to decline. The narrowness of these provisions means that an opportunity has been missed to better recognise and address integration that would help manage acknowledged risks to water resources. This contrasts notably with the broader (admittedly under-funded and under-implemented) method of addressing diverse

threats to EPBC-listed species using strategies outlined in recovery plans (EPBC Act, 1999, s270).

Recovering environmental water versus land-based infrastructure works (integrating land and water)

Arrangements in the MDB also see land-based activities as contributing positively to the environmental sustainability of Basin water resources. The Water Act (ss 3(d)(i), 74-79) explicitly warns that achieving an environmentally sustainable level of take may require reducing the amount of water taken from Basin water resources. However, public concerns about the social and economic impacts of the Commonwealth 'buying back' water entitlements led to a statutory limit being imposed on the volume of water entitlements that can be recovered (Water Act, s 85C). This means that delivering environmental outcomes now relies, to a significant degree, on land-based infrastructure activities, including both on-farm water efficiency works and off-farm works, such as lining irrigation channels, to 'bridge the gap' to meet sustainable diversion limits (Wang et al., 2018). In addition, 'supply measures', such as installing regulators (small weirs) to enable floodplains to be flooded under low river flow conditions, can lead to adjustments to SDLs on the basis of achieving equivalent environmental outcomes with less water (MDBMC, 2016). However, there are concerns about the value for money and environmental adequacy of these types of measures (Ernst & Young, 2018; Wang et al., 2018; Grafton, 2019). While these arrangements do integrate land and water management in one respect, critiques caution against treating the environmental outcomes of land-based activities as directly equivalent to providing environmental flows. In the northern MDB, water recovery targets were amended in 2018 on the basis of 'toolkit measures' to which state governments committed. These included installing fishways and works to reduce the effects of cold-water pollution on native fish. The MDBA proposed this suite of measures as an alternative to recovering environmental water as originally envisaged on the basis that they would reduce social and economic costs to irrigation-dependent communities, albeit with 'slightly reduced' environmental outcomes (MDBA, 2016 2).

Delivering environmental water (integrating water and biodiversity)

Integrating land, water and biodiversity also arises in the use of recovered environmental water. The Basin Plan also includes an environmental watering plan (EWP, set out in Chapter 8 of the Basin Plan) and requires Basin states to develop 'long-term watering plans'. These long-term plans prioritise the use of environmental water, including delivering water to floodplains (Basin Plan, cl 8.02(a)), and also involve the CEWH establishing and maintaining relationships with state and local entities to share information and deliver water (Horne and O'Donnell, 2014). Catchment management authorities in Victoria were established under an ICM paradigm through the *Catchment and Land Protection Act 1994* (Vic) and also manage broader catchment issues, for example pest species and land degradation. These relationships go some way towards providing the foundation for addressing a wide range of interacting resources and stressors, at least in Victoria.

The EWP and long-term plans aim to protect and restore water-dependent ecosystems, including by ensuring that 'water-dependent ecosystems are resilient to climate change and other risks and threats' (Basin Plan, cl 8.04). Yet the ways that the plans can integrate water and biodiversity are severely limited, being restricted to the delivery and use of environmental water only, rather than extending to biodiversity matters that could influence the effectiveness of environmental water. Further, in

practice, the plans apply in a geographically restricted way to major streams rather than water-dependent ecosystems throughout catchments.

Stewardson et al. (2017) argue that 'environmental water management will be more successful if planned within a broader program of ICM', since non-flow stressors (like invasive exotic species) can make it difficult to achieve the objectives of environmental watering. Thus, rather than focusing on delivering water in isolation, an approach informed by ICM and cumulative effects would 'diagnose' and address the interaction between the most important stressors in a catchment, for which a variety of technical methods are available. This would take account of interactions between stressors and maximise the benefits of the environmental water delivered.

More positively, the CEWH provides an institutional model for a Commonwealth entity capable of both coordinating with state agencies and environmental water holders and also directly delivering catchment management programs (though doing the latter may require legislative amendment). Programs analogous to buying, using, and monitoring the environmental impacts of water entitlements might involve buying environmental benefits (e.g. making stewardship payments to landholders) and monitoring the environmental impacts of improved land management practices designed to address aspects of integrated management that go beyond water quantity. A similar US federal program involves competitive grants to agricultural producers to take environmentally sensitive land out of production and engage in conservation practices (Stubbs, 2014). A historical appetite for Australian federal environmental institutions, such as the National Catchment Management Authority proposed two decades ago (Parliament of Australia, 2000), appears to have resurfaced in recent calls for a federal Environment Protection Agency (Fowler et al., 2017). This could equally form a new Commonwealth institutional approach to catchment management based on the approaches of the CEWH and the US federal stewardship payment program, involving both coordination and direct action, with the potential advantage of independence from state support and the Basin Plan (Grigg, 2012), and maintaining rigorous reporting on environmental outcomes, as are in place for environmental watering arrangements.

Dealing with water quality and salinity (integrating water and land)

Slightly stronger consideration of the impacts of land use emerges in relation to water quality. The Basin Plan's water quality and salinity management plan (WQSMP) contains valuable water quality targets and objectives, but it may not 'directly regulate' any of 'land use or planning in relation to land use', 'the management of natural resources (other than water resources)', or 'the control of pollution' (Basin Plan, section 22(10)). This provision echoes the constraints of the provisions relating to risks, outlined above, and obstructs 'holistic' ICM (Cotton Australia, 2011). It results in a potentially problematic need to align the Basin Plan with management strategies that do address these issues (MDBA, 2010), but which the Basin Plan may not directly influence. By comparison, a precursor to the WQSMP, the Basin Salinity Management Strategy, explicitly pursued an ICM approach (MDBMC, 2001b). It contained a much broader formal objective to 'control land degradation and protect important terrestrial ecosystems, productive farm land, cultural heritage, and built infrastructure at agreed levels Basin-wide' (MDBMC 2001b), including through supporting state land and water management plans, cooperative state action on land stewardship and direct action by the then Murray-Darling Basin Commission, for example financing farm forestry.

The MDB Agreement (integrating water, land and biodiversity)

Although much of the recent scrutiny on MDB arrangements has focused on the Basin

Plan, significant natural resources management mechanisms have developed over time and continue to operate under the MDB Agreement (Water Act, Sch 1; MDBMC, 2001a)). Beyond water quantity management, the MDB Agreement also:

- Grants the Murray-Darling Basin Ministerial Council (MDBMC) a function 'to consider and determine outcomes and objectives on major policy issues of common interest to the Contracting Governments in relation to the management of the water *and other natural resources* of the Murray-Darling Basin' outside of the issues provided for in the Basin Plan (Water Act, Sch 1, cl 9(a))
- Establishes a formal regime, initiated in the 1980s (MDBC, 1999) for managing salinity using 'salt interception schemes' that prevent salty groundwater from discharging to rivers, and a complex accompanying regime for salinity targets, registers that track credits and debits, and reporting, auditing and review obligations (Water Act, Sch 1, Sch B). The objectives of the original MDB salinity strategy included unabashed reference to controlling land degradation and preserving ecosystems with respect to salinity (MDBA, 1999)
- Led to a policy-based Natural Resources Management Strategy, which considered matters as broad as soil erosion, loss of native habitats, cultural losses of Aboriginal heritage sites and water quality problems, to be pursued through 'community-led action supported by government' (Blackmore, 1995) and input from state environment protection authorities, environment departments and agriculture departments (MDBMC, 1994; Blackmore, 1995).

The broad framing of these functions and actions clearly extend beyond the boundaries of the constraints presented in the specific mechanisms of the Water Act and Basin Plan outlined above. Implementation of the MDB Agreement thus offers the potential to go beyond the very constrained approaches to formulating strategies to respond to the risks to Basin water resources and to addressing water quality and salinity. However, this would require cooperation in relation to funding, either through Basin states agreeing to fund programs at an increased level, or agreeing to Commonwealth-funded programs.

Water information (integrating water, land and biodiversity)

Unlike the MDB arrangements, the water information provisions of the Water Act apply across Australia. Environmental information is a key prerequisite to managing cumulative environmental effects (Nelson, 2019; Jones, 2016). The Commonwealth Water Act charges the Commonwealth Bureau of Meteorology (BOM) with collecting, holding, managing, interpreting and disseminating water information, as well as undertaking and commissioning water investigations (Water Act, s120). The Bureau may request water information from a person, and regularly receives water information from government entities and some private power entities (Water Act, ss126-127; *Water Regulations, 2008 (Cth)*). The term 'water information' is defined broadly to include information not only about water itself, but also 'contextual information' including land use, geological and ecological information (Water Act, s125). This mirrors a similar integrated view as is evidenced in the definition of 'water resources'.

Although BOM does not currently collect broader information, such as that concerning land use and ecology, doing so would clearly support a more integrated approach to water, land and biodiversity. Legislative change could expand this approach to one closer to environmental accounting, which would accord with past proposals for a central Commonwealth role in relation to environmental information, including one for

an independent statutory 'National Environment Audit Office' with 'power to collect relevant data and maintain an ongoing audit of the state of Australia's catchment systems' (Parliament of Australia, 2000) and another for a 'National Environmental Information Management System' that would include regional and project-specific environmental data (Hawke, 1999). A systematic approach to integrating project-level environmental assessments related to catchment stressors into Commonwealth-compiled information for use in water planning processes would also significantly enhance data availability (Ball et al., 2013; Nelson, 2019). However, requiring increased information flows may also require the Commonwealth to increase the funding originally allocated to states to develop their water information capabilities.

Potential for change based on current foundations

It is beyond the scope of this Chapter to recommend a particular governance structure that would best support a greater Commonwealth role in integrated management of the MDB. However, the current foundational elements of integration in the MDB as analysed above suggests three broad options along a spectrum of intervention and cooperation. While some of these fall under the familiar umbrella of cooperative federalism, others would represent a stronger leading Commonwealth role. These options might be considered in 2024, when the Water Act is to be reviewed, and in 2026, when the Basin Plan must be reviewed.

Option 1: would be simply to expand the Commonwealth role in information gathering, using existing water information provisions of the Water Act, and use other existing legislative provisions to their fullest extent where current practice falls short of legal potential. This approach would help meet the data-hungry nature of scientifically informed WRPs that could meaningfully monitor and respond to cumulative environmental effects and incremental environmental change.

Option 2: would be to build on a cooperative, collaborative approach between the Commonwealth and Basin state governments, based on the MDB Agreement and/or a strategic assessment under the Commonwealth EPBC Act. This could take the form of agreed initiatives and information gathering or even natural resources plans as foreseen in the original MDB ICM Strategy. These fall short of regulation, but could achieve broader reach in integrating natural resources issues, as demonstrated by even the brief history outlined above. Initiatives based on the MDB Agreement could respond directly to the current constraints in the Water Act in relation to the scope of strategies to respond to risks to Basin water resources, plans for environmental water, or methods of pursuing water quality targets or objectives. This option would ideally be combined with an expanded information-gathering role.

In addition to using the water information provisions of the Water Act, the Commonwealth EPBC Act provides for strategic environmental assessments ('strategic assessment'). These are also fundamentally about information, but also provide for the Commonwealth to assess the impacts of actions under a policy, plan or program and endorse the policy, plan or program if the assessment report adequately addresses those impacts. However, unlike the water planning mechanisms under the Water Act, the EPBC Act does not provide for any enforcement mechanisms in relation to the commitments made by relevant entities related to strategic assessments. It is notable that a formal independent review of the EPBC Act recommended applying a strategic assessment to the Basin Plan (Hawke, 2009).

A recent strategic assessment of the Great Barrier Reef, under the EPBC Act, which

included a focus on catchments and cumulative impact management (DSDIP, 2014; GBRMPA, 2014), could inform an updated review of how such an assessment could best assist cooperatively to expand integrated management related to the Basin Plan.

Options 1 and 2 avoid reforms that would directly affect the Basin Plan, which has been subject to political controversy and even some state threats to withdraw their referrals of legislative power to the Commonwealth (Walker, 2019). Introduction of these options would likely require Commonwealth funds.

Option 3: would be to introduce a Commonwealth regulatory approach, imposing binding state obligations to expand the contents of WRPs to take a more integrated approach that included land use and biodiversity concerns, potentially extending to social and economic considerations, based on the Basin Plan governance structure. This option could also involve a wider role for a CEWH-type entity in coordinating and directly delivering stewardship-type catchment management programs. The constitutional basis for such an expansion would need to be considered, for example by seeking additional referrals of state powers, supported by funding, and exploring the limits of legislative action to pursue Australia's international obligations. It appears this option, even to the extent of simply coordinating water plans and natural resources management plans, was deemed outside the relevant statutory mandate at the time of the preparation of the current Basin Plan (Hamstead, 2011). The current political fragility of Basin Plan arrangements, and the likelihood of state resistance to what could be viewed as a Commonwealth 'takeover' of land-based activities, means that this option is likely to be difficult to achieve in the short term, particularly if it requires legislative change or a referral of state legislative powers.

Thus, a consideration of the foundational elements of current MDB arrangements has revealed feasible options for improving the integration of water, land and biodiversity, and responding to cumulative environmental effects in the MDB.

A contrasting catchment governance initiative: The Yarra River and its catchments

This Section reviews an Australian case study that seeks to better integrate land, water and biodiversity considerations in the catchments of the Yarra River in Victoria, highlighting how the underlying legal approaches adopted in this case could contribute to addressing key MDB concerns regarding an integrated approach that recognises cumulative environmental change.

Victoria's *Yarra River Protection (Wilip-gin Birrarung murron) Act 2017* (Yarra Act), enacted in 2017, seeks to protect the river and certain public land as 'one living and integrated natural entity' (Yarra Act, s 1(a)), informed by traditional Wurundjeri views. It brings together an array of legal mechanisms, including a plan-based approach, to connect the Yarra River with its catchments across eight municipalities (Yarra Act, s 15(3)). This case study introduces two main mechanisms used in the Yarra Act, then discusses how they better integrate management of the catchment and contrasts them with MDB arrangements.

First mechanism - the Yarra Act sets out 'Yarra protection principles' that reflect ecological values such as biodiversity and ecological integrity, social and cultural values such as recreation, amenity, and Aboriginal cultural values (Yarra Act, ss 8-13). Interestingly, no clear hierarchy structures the principles in the Yarra Act, unlike under

the Commonwealth Water Act. A statutory 'long-term community vision' elaborates these values for four river reaches (Yarra Act, ss 17(2), 20(1)(a); Melbourne Water, 2018).

Second mechanism - a Yarra strategic plan (YSP), which has not yet been finalised as at February 2020, provides a legally binding framework to operationalise these principles and vision. The YSP has different effects in different parts of the catchment - 'Yarra river land' encompasses the bed, soil and banks of the river, and a declared area of public land adjacent to or 500 metres from the Yarra River. The YSP will apply to this area and also to a larger area of land, which has not yet been declared, but will include public and private land within one kilometre of the riverbank and potentially land in the adjacent municipalities. At its maximum extent, this would cover most land in the Yarra catchment. Parts of the YSP will be legally binding and others will not.

Among its components will be: 'performance objectives for waterway health, river parklands amenity, landscape amenity and environmental, cultural and heritage values'; projects for protecting and improving Yarra River land; 'a decision-making framework against which individual projects and proposals may be assessed or evaluated'; and a land use framework plan that identifies areas for particular purposes (for example 'riparian zones and areas of high environmental or landscape value that must be protected from development', areas for commercial activities, and habitat corridors). The breadth of the YSP and its nature as a tool for integrated management is also reflected in the requirement that it be prepared 'having regard to any relevant legislation, current policies and plans of the Government and responsible public entities relating to land use, waterway health, biodiversity, cultural heritage, transport or other social, economic or environmental policies or plans relevant to Yarra River land' (Yarra Act, s 18(2)(e)).

The Yarra protection principles and the YSP (including its performance objectives) will take effect by influencing a very wide range of statutory decision-making processes, including under legislation relating to planning, water, local government, Crown lands, forests, and wildlife. Depending on the context, decision-makers must either act not inconsistently with the YSP, or must have regard to the Yarra protection principles or YSP. These obligations arise when the relevant power or function is being exercised 'in relation to the YSP area that may affect Yarra River land'. These provisions require decision-makers operating in diverse environmental contexts to consider the ways in which activities in the catchment may affect the river and immediately adjacent public land, and they do so with stronger legal effect than is the case with current catchment-related strategies.

The process of preparing the YSP is also noteworthy for the way that it calls for the active participation of many diverse stakeholders in the Yarra catchment. Melbourne Water is to prepare the YSP. A long list of 'responsible public entities' and the relevant Ministers, who will play an important role in delivering the Plan when they consider it in their own decision-making, before it can be approved, must endorse the YSP. The draft will then be subject to extensive public consultation processes involving public hearings and ultimately approved by the Minister (Yarra Act, ss 23-40). Responsible public entities must report regularly on how they implement the YSP (Yarra Act, s 43). An independent Birrarung Council advises the Minister on overall implementation of the YSP (Yarra Act, ss 47, 48).

Relevance to the MDB

The YSP arrangements contrast with current MDB arrangements in addressing

integrated management and cumulative effects. The Yarra protection principles and YSP address a broader range of social and environmental issues, for example, biodiversity, amenity and cultural values (although the YSP's precise legal effect, including on water quantity management, will remain unclear until the YSP is approved, and the degree to which the broadly framed Yarra protection principles will have effect on the ground is also, as yet, unclear). Nonetheless, the mechanism of broad principles that a community group elaborates, and that must be considered by decision-makers, offer an inspiration for reforms to better integrate water, land and biodiversity. The YSP arrangements also involve a complex multi-jurisdictional environment involving multiple state government agencies and eight local governments, a group that has sometimes involved tense relationships (albeit over a shorter history, and arguably with more asymmetrical powers than in the MDB).

The Yarra arrangements are also notable for involving a more diverse set of stakeholders that are formally consulted and directly legally affected, and more intensive formal public consultation (including hearings). This reflects the greater degree of participation involved in a higher degree of biophysical integration between a water resource and its catchment, when property rights to land and many more decision-makers and stakeholders are affected.

The YSP also takes a fundamentally different approach to incorporating an Indigenous worldview about biophysical integration. It casts its overall approach to integrating the Yarra River with its catchments using an Indigenous worldview that sees these elements as 'one living natural entity' - a striking statement of integration. This contrasts with MDB arrangements that tend to take a narrower approach to seeking information about Indigenous objectives and values (see Chapter 15 of this volume) in a way that may tend to focus on water and waterways with less emphasis on catchment land and biodiversity (Basin Plan, cl 10.52).

Conclusion

In the mid-1990s, the MDB Commission's Chief Executive cast water sharing as 'an important precursor to co-operative management of the basin's natural resources' (Blackmore, 1995). Blackmore saw a more expansive, integrated view of MDB management as its logical endpoint. Commonwealth legislative action to respond to the perceived failures of intergovernmental cooperation led to an emphasis on water quantity - an 'integration focus limited to water resources' (Marshall et al., 2013).

However, key objectives, concepts and mechanisms introduced in the Commonwealth Water Act allow for broader integration of land, water, and biodiversity, with an eye to cumulative environmental effects, albeit with some important current statutory limitations and ambiguities. Nonetheless, these foundational elements could pave the way for a stronger integration approach. The history of a broader approach under the MDB Commission, and the cooperative MDB Agreement mechanisms, which are still current, reinforce the potential for a stronger future approach to integrated management in the MDB. Three broad options for a stronger Commonwealth-led approach were presented, each with its own advantages and disadvantages and political and funding implications: first, expand the Commonwealth role in information gathering to better monitor and respond to cumulative environmental effects and incremental environmental change, recognising relationships between land, water and biodiversity; second, build on a cooperative, collaborative approach between the

Commonwealth and MDB state and territory governments using existing legal vehicles (the MDB Agreement and/or a strategic assessment under the Commonwealth EPBC Act); and third, investigate introducing a Commonwealth regulatory approach that would expand the contents of WRPs to include land use and biodiversity concerns, based on the Basin Plan governance structure.

Recent and emerging developments in integrating the management of land, water and biodiversity in the Yarra River catchments raise additional possibilities: broader formal statements of decision-making principles that clearly recognise interrelated social and environmental issues, supported by a natural resources plan to guide the authorisation of activities under state law.

Principles of integrated resource management and cumulative effects provide a useful focus for potential reform efforts. The cumulative effects literature is also itself informed by analysis of the MDB arrangements. It bemoans the common failure to connect project level and regional understandings of cumulative environmental effects, and the establishment of legislative structures for ongoing regional level cumulative effects assessments that influence decision-making (Dubé, 2003; Ball et al., 2013; Noble and Basnet, 2015). In the MDB, capping water extraction using legally binding SDLs that are established based on formal environmental considerations provides a rare example of this approach, albeit one that requires modification to achieve a more integrated approach.

The leadership represented in past and present management and policy arrangements in the MDB should be celebrated. However, it is argued in this Chapter that decision-makers need to go further with reforms to improve the integrated management of water, land and biodiversity in the MDB. Each of the reform options canvassed in this Chapter, and the ways in which the Commonwealth might drive them, should be considered in the reviews of the Water Act in 2024 and the Basin Plan in 2026.

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