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Abstract

In January 2007 Prime Minister John Howard announced 'A National Plan for Water Security' which provided a planned investment of $10 billion over 10 years to address the challenges of water inefficiency, over-use and over-allocation. Although the plan was national the primary focus was the Murray-Darling Basin (MDB). Much of the proposed expenditure was for improving water efficiency ($4.765 billion) and market-based water recovery ($3 billion) to reduce the over allocation of water in that region. These proposals initiated a period of intense negotiation and planning for institutional reform that will continue. This paper provides criteria to review The Plan and to guide policy makers charged with addressing the challenges of water management in the MDB.

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Planning for water security in the Murray-Darling Basin

The ‘big dry’ in South-east Australia has focussed policy makers on what is wrong with water policies in Australia in both urban (Quiggin 2006) and rural environments. Building on the 2004 National Water Initiative (NWI), Prime Minister Howard on 25 January 2007 announced a major funding and policy initiative, titled ‘The National Plan for Water Security’ (The Plan), to help address the problems of water inefficiencies, over use and over allocation in the Murray-Darling Basin (MDB), and inadequate data and modelling of water availability and use.

The Plan included 10 key points and a proposed expenditure of $10 billion by the Australian government over the next 10 years conditional on States agreeing to a proposed set of governance arrangements in the MDB. Much attention has been focussed on the politics of The Plan and, in particular, the request of referral of state and territory powers to manage the MDB in the national interest. Although the governance issues are important, the planning processes and the economics of how the proposed $10 billion (Table 1) is to be spent will be critical to its success.

This paper provides a critical review of The Plan with the purpose of guiding policy makers charged with addressing the challenges of water management in the MDB. First, we review the key characteristics of the MDB and the history of its management. Second, we outline the criteria for evaluating water security and, third, address some of the pitfalls and opportunities to achieve national water security.

The Murray-Darling Basin

The MDB is just over a million square kilometres in size and has a diverse range of landscapes, ecosystems, land uses and climates ranging from the tropical north to the temperate south with its long dry summers, wet winters and snowfields. It includes over 30,000 wetlands, eleven of which are listed under the Ramsar Convention of Wetlands of International Importance. Divided between the southern and eastern Australian states of New South Wales, Victoria, South Australia and Queensland and the Australian Capital Territory (ACT), the region is home to just under two million people, supplies much of the water used by another million in South Australia and generates approximately 40 percent of Australia's agriculture and pastoral production (Blackmore 2002, p. 7). Those two million people and various industrial activities use about 4 percent of the water diverted from the region's rivers. The other 96 percent is used by irrigated agriculture and constitutes about two thirds of national rural and urban usage.

The addition of a federal overlay of six jurisdictions provides an extra political dimension that is not found in any other major Australian river system. Despite the existence of a near century old inter-jurisdictional water management framework, environmental degradation of the region's surface and groundwater bodies and their catchments is intensifying, resource security is declining and the debate about the future water use is gathering momentum. In addition to the impacts of reduced flows from irrigation the main threats in the MDB include salinity and nutrient pollution caused by changing land management practices in the catchments. This is exacerbated by the fact that the Murray-Darling is a low energy system with little capacity to purge itself of salts and sediments. For instance, much of the salt that is mobilised into streams is not flushed out of the Murray Mouth, but is redistributed elsewhere in the basin to what were previously fertile low lying areas, or onto floodplains of high environmental value.

In sum, the MDB is now a severely modified river system that bears little resemblance to that which the first European settlers found in the mid nineteenth century. To address these challenges systems of land use are needed that generate sustainable incomes in contrast to some of the existing activities that dominate the catchment and that have contributed to overuse of water and other natural resources.

Water Management in the Murray-Darling Basin

Starting from first principles there have been two noteworthy attempts by governments to assess what is required to manage the MDB — the first in the early decades of the twentieth century and the second in 1980s. The early royal commissions that led to the River Murray Waters Agreement (RMWA) in 1914/15 stressed the need for a catchment-wide approach to policy and management. After years of difficult negotiation the RMWA put in place a tightly conscribed water sharing agreement. This agreement eventually broke down in the 1970s and 80s under pressure from growing development pressures and increasing salinity problems. In the mid 1980s the River Murray Commission was replaced by the Murray-Darling Basin Ministerial Council, the Community Advisory

Committee and the Murray-Darling Basin Commission. The new bodies were designed to take account of a broader range of political, community, productivity and environmental interests (Kellow 1995, pp. 220-238).

The institutional inadequacies of the current governance system in terms of its capacity to halt the ongoing decline in environmental condition and resource security have been highlighted over the period 2005-2007 by the worst drought since European settlement. It was in response to these challenges that Prime Minister, John Howard, announced in January 2007 that the Australian government would invest $10 billion to reform rural water management and take over control of the MDB from the States.

The Prime Minister's proposal built on two key recent reforms in federal water policy: the 1994 Council of Australian Government (COAG) reforms and the 2004 National Water Initiative (NWI). The COAG reform and the creation of the MDB Ministerial Council put in place 'the Cap' on surface water diversions in the catchment that has been a key limit on water use. The COAG reforms are also noteworthy for the promotion of market-based approaches to address water scarcity and, in particular, the removal of unnecessary restrictions on water trading. The NWI extended the COAG reform agenda and provided a framework to increase water security through more robust water entitlements, removal of unnecessary barriers to water trading, and comprehensive water plans to ensure sustainable diversions to conserve environmental condition of both surface and sub-surface hydrological systems.

Criteria for Improved Water Security

Before reviewing the pitfalls and opportunities of the Prime Minister's plan for national water security it is helpful to review what is 'water security' and how can it improved. First, and foremost, water security is about sustainability. Current land and water use must allow for environmental 'use' that can sustain and improve upon a range of performance measures such as biodiversity, aesthetics, recreation as well as agricultural production. Without such security no plan for the MDB will be judged to be successful. Ultimately, water security is not so much about precise quantities of water availability, but ensuring that under a range of conditions (droughts, floods and everything in between) the environment and farming systems are resilient to shocks.

Achieving water security is difficult. Australians have been trying for more than a century using modern agricultural practices and various types of institutional structures and have, so far, failed. At a minimum, water security must include the following elements:

1. Full consideration of the interdependencies whether it be between ground and surface water, upstream and downstream use, recreational and irrigation, land use and water quality and all other important feedbacks within the system. This requires both good bio-physical understanding, but also institutional structures that allow consideration of the impacts of actions on others, spatially and temporally.

2. Adaptable management that recognises that there are inherent uncertainties in the MDB system and the managers need to plan for alternative scenarios. It demands experimentation, especially of different management approaches, to learn from past successes and failures, and to improve upon existing decision-making.
3. Explicit recognition of the trade-offs across competing uses and non-uses within the basin. Until and unless there is an understanding of the net benefits associated with directing water to different uses — to irrigation from the environment or vice versa — decision making will be at the whim of the political interests and influences of the moment that may not be in the long-term interest of water security.
4. Governance arrangements that promote transparency at both the macro-level, such as the setting of overall limits on water use, to the micro-level in the form of reliable price and quantity data on trades, and also proper monitoring of water use. Good governance also requires clear lines of authority so that those responsible for decisions are held accountable for their actions.
5. Capacity both in terms of human capital and financial resources to effectively manage a highly complex system such as the MDB. Desirable management processes and procedures will fail without adequate institutional capacity.

The Plan: Public versus Private Benefits

The package put forward in January 2007 by Prime Minister John Howard proposed expenditures of $10 billion over 10 years (see Table One). Most of the funds are directed to improving water efficiency through improvements in infrastructure ($4.765 billion) and market-based water recovery through the purchase of water entitlements to reduce overallocation ($3 billion) and increase environmental flows. Other important expenditures include $480 million to improve water information, $620 million for water metering, monitoring and accounting, and $600 million to reform the existing Cap and to improve management operations in the MDB. These funds from the Australian government were made conditional on Queensland, Victoria, New South Wales, South Australia and the ACT agreeing to new governance arrangements that will transfer all their powers in relation to the Murray Darling Basin Commission (MDBC) so that it becomes an Australian government agency that reports to a single federal minister.

By any financial measure the planned $10 billion expenditure is both large and necessary if water security was to be improved. The key question, however, is to what extent will the almost $8 billion allocated in The Plan for water efficiency improvements and market-based water recovery generate the stated objective of a '…radical and permanent change in our water management practices' and achieve water security? Moreover, will the proposed expenditures yield at least the same amount in public benefits?

Public benefits arise from what economists call 'externalities' where the actions of individuals impose costs on others and these actions are not accounted for in individual decision-making. Thus, the external costs cannot be resolved without some form of intervention. For instance, a farmer who diverts water to irrigate crops imposes cost on others that are not included in the price paid for delivering and using the water. This could arise from evaporation in irrigation channels that reduces the water available to downstream users and for environmental purposes, or from water seepage that could contribute to salinity to other farmers.

The key for decision makers is to ensure that when intervention is required, such as when investments are made in water efficiency improvements, that the public expenditures generate the highest possible net benefits. A template to guide public investments developed by Pannell (2006) adapted to evaluate the proposed expenditures in The Plan is provided in Figure One. On the vertical axis are public net benefits ($) that accrue to society (other than water users) where above the horizontal line that bisects the figure they are positive, and below are negative. On the horizontal axis are private net benefits ($) that accrue to individual water users that are positive to the right of the vertical line that bisects the figure, and are negative to the left. The centre of the box is the point where both public and private net benefits are zero.

Figure One illustrates that different interventions to current practices generate alternative combinations of net public (that accrue to everyone but the irrigators) and private (that accrue directly to the irrigators) benefits. Water efficiency investments that generate negative net public benefits are to be avoided as the public funds could be used for other purposes that would generate a higher and positive rate of return. Consequently, no projects used to modernise irrigation, for example, should be located in the bottom half of the box (the south-west and south-east squares). Public funds should also not be used to pay for infrastructure projects that would occur in the absence of public intervention, or those infrastructure investments that already generate positive net private benefits. In other words, using public funds to subsidise investments that irrigators would pay for anyway simply ‘crowds out’ private investment and fails to increase net public benefits over what would have occurred in the absence of the infrastructure subsidy. Thus no public funds should fund infrastructure investments and water efficiency savings in the right-hand side of the box (the north-east and south-east squares) because such interventions would be undertaken privately without any need for taxpayer dollars.

The only ‘policy space’ in which to spend the funds allocated for promoting water efficiency is that area of the box (north-west square) that generates positive net public benefits that would not occur without the Plan. In other words, this north-west square denotes investments that generate positive net public benefits (such as from increased environmental flows), but in the absence of subsidies would result in negative net private benefits to water users. Moreover, within this north-west square, the interventions needed to generate efficiency gains by water users should generate net positive public benefits at least as large as the net private costs that the projects impose on irrigators. This condition ensures the overall (public and private) net benefits from modernising Australian irrigation are positive, denoted by the shaded triangle area within the north-west square of the box.

The challenge for decision makers charged with spending billions of dollars over the next 10 years on modernising irrigation infrastructure is to ensure expenditures are made in the appropriate area of the public/private net benefit combinations (shaded triangle area of the box). To ensure the public receives the highest net return for each dollar of expenditure, policy makers will need to resist calls by self-interested landholders to direct public investments into projects that generate the highest net private (rather than public) benefit.

The Plan: Water Efficiency Improvements

A major challenge in The Plan is to determine the trade-offs between the costs of actions (such as infrastructure improvements) designed to overcome water problems (such as too much water seepage and evaporation) with the public benefits (such as larger water flows downstream) of such actions. Quantifying these public benefits is difficult, but is possible within some confidence limits. It is also true that whatever the action chosen to generate the public benefits the marginal public returns will eventually decline with the amount invested. Moreover, improving water efficiency may, in some circumstances, reduce environmental flows. This is because water losses in irrigation include not only those attributable to transpiration and evaporation, but also water than would otherwise be returned to the hydrological system via seepage or other means (Productivity Commission 2006). Thus investments that increase water efficiency, but also reduce return flows, could potentially reduce environmental flows exacerbating the overuse of water in the Murray-Darling Basin.

The other key issue in promoting water efficiency gains is that although it may be technically feasible to achieve very low rates of evaporation in irrigation delivery, it could cost more than alternatives, such as changes in land-use practices that would save the same amount of water. The point is that whether it is appropriate to allocate $3.13 billion under The Plan to generate system efficiency gains, or $1.635 billion on on-farm efficiency gains, is warranted depends very much on the expected returns from such an intervention, and also the alternatives available — what economists call ‘opportunity costs’.

The key point is that expenditures of public money for public benefits, as announced in the Plan, should not be constrained to particular investments or infrastructure, but should be allocated to those approaches that generate the highest marginal water savings.

The Plan: Market-based Water Recovery

The Plan includes expenditures of up to $3 billion to buy-back water entitlements held by irrigators in the MDB that is intended to reduce water use. It represents a major funding injection to support a 2004 COAG Intergovernmental Agreement on Addressing Water Over allocation and Achieving Environmental Objectives in the MDB. The Plan greatly expands the scope of this 2004 initiative that sets out arrangements for a ‘Living Murray’ with a budget of $500 million to return 500 billion litres of water per year to the Murray River by 2009. The Plan also builds upon a 2006/07 Australian government to retire water entitlements in a reverse tender for farmers who agree to undertake water efficiency improvements equal to the amount of water tendered for sale (Grafton and Hussey, 2007).

A justification for the public purchase of statutory water entitlements is the over use of water — too much is consumed and not enough is left to maintain healthy river systems. For instance, a 2003 Expert Reference Panel (see Table 2) predicted that without increased flows of 1,630 billion litres there was little chance that the Murray River could be returned to a 'healthy' state (Jones et al. 2003). A second reason for the purchase of water entitlements is that there is over-allocation of water entitlements, whereby the combined amount of water entitlements exceeds the amount available for water use. According to the baseline assessment of water resources for the National Water Initiative published in June 2007, the total sustainable yield for the MDB was 14,533 billion litres and the total of entitlements was 18,368 billion litres, an over-allocation of nearly 4,000 billion litres (National Water Commission 2007, p. 61). Over allocation is different to over use in that in a given year not all entitlements will be fully utilised, but it can contribute to less than desirable environmental flows because decision makers may be less inclined to reduce water use allocations (or increase environmental flows) in an over-allocated river system because of the costs it imposes on water users.

A major challenge in generating public benefits from the purchase of water entitlements under the plan is to purchase the appropriate mix of water entitlements of high and general security water such that there is sufficient water for environmental purposes. Irrigators are also concerned that the proposed purchases will raise the market price thereby penalising net buyers of water entitlements. Another issue in terms of market-based water recovery is that water entitlements are denominated as gross flows or diversions and do not account for return flows to the hydrological system (Young and McColl 2003). Given that different water uses generate different return flows — grape production, in general, has smaller returns flows as a proportion of total water use than rice production — consideration should also be given as to what is the current use of water entitlements when purchasing entitlements for the purpose of environmental flows. In other words, the purchase of the same quantity of water entitlements from farmers with low return flows will generate greater environmental flows than if purchased from farmers with high return flows.

The challenge of acquiring the appropriate portfolio of water entitlements to meet environmental goals does not imply that market-based recovery is not needed. The point is that it represents both an opportunity and possible pitfall to achieving improved water security. Moreover, given the considerable biological and physical uncertainties associated with water yields it will be a complicated and difficult task to manage a mixed portfolio of entitlements of different securities for environmental purposes within the political constraints. Further, the success of such management and market-based water recovery will greatly depend on the setting on an appropriate cap on overall use that explicitly accounts for 'sleepers' (entitlements that have never been used) and 'dozers' (entitlements that have previously been used but are not currently in use) and to treat such entitlements when purchased by the Australian government as 'in use' when setting the overall Cap.

Securing a Water Future

One of the aims of the Plan is the introduction of a revised and comprehensive Cap in the MDB on diversions of surface and groundwater for human consumption and activities such as industry, mining and irrigation. A cap on surface water is already in place, but an indication of what further needs to be done to make it comprehensive was provided by the five year review of its effectiveness conducted in 2000. One of the most significant sections of the five year review and its four companion papers apply to implementation and compliance. Two of those companion papers were provided by the Independent Audit Group (IAG). The IAG has worked as the outside auditors of the Cap since it was introduced in 1995 producing annual reports on the compliance of the states and so is in a good position to understand its strengths and weaknesses. The IAG listed five 'refinements' to the Cap as highly desirable:

- management of groundwater on an integrated basis with surface water within the spirit of the Cap;
- completion of the compliance tools (computer simulation models used to determine cap target diversions) throughout the Basin;
- introduction in each jurisdiction of an appropriate quality management system for the management of metering, monitoring and reporting data;
- development of less restrictive trading rules within and between valleys and jurisdictions; and

- development of a register of agreed Cap definitions (Murray-Darling Basin Ministerial Council 2000, p. 30).

Since the five year review in 2000 each of the IAG's annual reports have commented on the efforts of the states to deal with these five issues. Overall progress has been glacial. An effective cap will require substantial progress in all five recommendations, but for the purposes of this paper it is useful to highlight the situation regarding groundwater.

Groundwater

The proposal that groundwater should be managed on an integrated basis with surface water accords with best practice world-wide. In many places such as Arizona and California, storage of what was previously surface water in groundwater systems is established practice (Blomquist et al. 2004). Among other things it has the advantage of avoiding evaporation losses which can be considerable. Integrated management of surface and groundwater is not easy, however, because the relationship between the two varies from catchment to catchment and between different parts of a given catchment. The rate at which they interchange depends on the level of groundwater in the landscape around surface water bodies, the porous or non-porous nature of the soils and many other factors. That said, the argument for managing both manifestations of the hydrological cycle together is overwhelming in principle, and it has long been known that in practice failure to do so can seriously compromise attempts to manage either one in isolation (Sinclair Knight Merz 2003).

The recent baseline assessment of water resources for the National Water Initiative 2005 just released by the National Water Commission notes that in many catchments surface water and groundwater interchange with each other. As part of the normal hydrological cycle, water from rainfall and surface water bodies, seeps to the groundwater table. Similarly, surface water bodies, both flowing and non-flowing, gain much of their water from groundwater seepage through the banks and beds of streams and lakes. Groundwater pumping nearby causes surface levels to drop. This is particularly so when the surface water body is contained within porous soils. There is ample evidence that in many districts where the availability of surface water has declined, either because of institutionally imposed restraints or through declining availability as a result of reduced stream flow, diverters in the MDB have compensated by increasing the rate at which they pump from groundwater (Sinclair Knight Merz 2003). The capacity of the new institutional arrangements to implement an effective Cap of both surface and groundwater will be a major test of The Plan's adequacy.

Water for the Environment

Another test of the institutional arrangements that will emerge over the next few years will be their capacity to manage environmental water across State borders. The limited nature of the existing institutional framework in the MDB is well illustrated by considering the following scenario, implementation of which is now being seriously considered by Victoria and New South Wales. The difference between South Australia's regular entitlement of 1,850 billion litres, as specified in the MDB Agreement, and the average flow over the border at a little less than 5,000 billion litres is very large.[1] While the Cap process limits the volume of water that can be used for human consumption, industry and agriculture, there is nothing in the MDB Agreement or other agreed policies that requires the two upper states to deliver more than the minimum at the border. This means that the very large difference of approximately 3,000 billion litres between the two flow figures could be used for environmental purposes in New South Wales and Victoria.

For the two up-river Murray states this would produce major environmental improvements and ease the political pressure to reduce allocations to their irrigators to achieve that result. A typical use would be to pump this ‘environmental water’ onto a riverine wetland and let it work its way slowly back to the river. Taking account of losses with each use and increased salt and nutrients that would be picked up as it drained through the floodplain, this would allow a given environmental allocation to be used a number of times. This would result in considerable environmental benefits in the upper states, but depending on how extensive the practice became it would cause serious additional degradation in South Australia.

The salinity levels predicted by the Salinity Audit assumed that all water not used within the Cap in the upper states would flow across the South Australian border. Smaller flow volumes, however, would reduce the dilution of the saline groundwater seeping in from the Victorian and South Australian mallee and result in significantly higher salinity figures in the lower reaches than predicted by the Salinity Audit. It would also drastically

[1] This figure is based on flows over the past century. There has been almost no flow out of the Murray Mouth in recent years.

reduce the frequency of low and medium level floods and, thus, have a negative impact on the Murray's flood plain in South Australia. Indeed, according to the five-year review of the Cap on extractions, the current average flow over the border of just under 5,000 billion litres results in about a 28% flow at the Murray Mouth compared with pre-development conditions. This reduction has increased the frequency of drought years in the Coorong and around the lower lakes near the Murray Mouth from about 5% to over 60%. To reduce flows over the border to 1,850 billion litres would make that situation much worse as over 2,000 billion litres at the South Australia border is needed before there is flow out of the Murray Mouth.

Taking a Basin-wide perspective, the potential benefits of increased diversions of water for environmental purposes in the upper parts of the catchment may well out-weigh the costs to the lower reaches, but the institutional arrangements now in place in the MDB mean that this scenario will not be subjected to the discipline of such a test. Veto by any one jurisdiction, either Victoria or New South Wales, will keep the issue off the agenda of the Ministerial Council. One of the potential benefits to be looked for from the enhanced role of the national government under the new institutional arrangements is that the ability of individual States, such as Victoria, to block basin-wide assessment of the costs and benefits of their proposed activities will be negated. The management of flows over the South Australian border will provide a test of the robustness of the new arrangements.

Institutional Capacity

A critical issue that has been largely ignored so far in the Australian water debate is the shortage of skilled people able to do the range of tasks required for contemporary water management if it is conducted at the level required by the NWI. Management of hydrological systems is much more complex than it was only a few decades ago. Most regions of the MDB are now severely modified and subject to much more intense competing pressures than was the case in the past. Experience with these systems when they were less modified is not always a reliable guide for the present and future.

In addition to long standing issues related to the level of extractions and salinisation, the list of water management issues in the MDB in the early twenty first century now extends to acid soils, nutrient pollution, carbon depletion, changing patterns of rainfall, run-off and recharge, loss of native vegetation, threatened biodiversity, declining connectivity between floodplains and streams channels, changes to the seasonal pattern of flows, thermal pollution downstream of dams, Indigenous issues, degraded amenity, the social impacts of economic and environmental change, climate change and more. Management is made even more complex by the fact that many of these problems involve different levels of government, occur on private land or are influenced by the activities of commercial companies. In particular, management of water quality issues such as salinisation required frequent negotiations with landholders, communities, other government agencies and scientific researchers and need very different skills from those required to manage water storage and delivery systems, the priorities of the system in place for most of the twentieth century.

Where will these 'super' water managers come from with the requisite skills? Future demand will be much greater than now, but there are already serious shortages of people with the necessary skills. This personnel gap is emerging at the same time as similar shortages are becoming serious in many other spheres of Australian life. Shortage of skilled personnel to manage Australia's highly modified hydrological systems could well prove the greatest source of risk to the NWI and Australian water management in the medium term. In addition to dealing with the many and various current disputes that confront water policy makers in the MDB, the new system will also need to deal with these fundamental capacity issues.

Concluding Remarks

If the 2007 effort to reform the institutional arrangements in the Murray-Darling Basin falters, the cost will be continuing decline in environmental condition and resource security throughout the region. Given the high potential cost of failure it is essential that great care be exercised in both the design of the next generation of institutions and in the proposed expenditure of billions of dollars of public funds.

Full recognition of the complex interdependencies that shape outcomes in the Murray-Darling Basin will be central to this process. Managers in the region will need innovative adaptive techniques able to make tradeoffs between irrigation and the environment, and to take account of factors such as the increased variability that will result from climate change. The Basin is now a mature system where further development will require efficiency gains and cannot come simply from increased extractions. Effective governance processes able to mediate between competing interests will be essential to reduce the transactions costs that will ensue. Moreover, the upgrade in the quality of management that the 2007 reforms are meant to achieve will need to be supported by substantial investment in human and institutional capacity to improve water security in the Basin.

Table One: A National Plan for Water Security

Proposed Expenditure ($ billion)	Amount
Modernising Irrigation in Australia (total)	5.885
- Delivery system efficiency gains	3.13
- On farm efficiency gains	1.635
- Metering, monitoring and accounting	0.620
- Improving river operations and storage	0.500
Addressing Over Allocation in the MDB (total)	3.000
Reforming the MDB Commission (total)	0.600
- Set and administer a new cap	0.100
- MDB Commission operations	0.500
Water Information (total)	0.480
- Modernising and extension program	0.080
- Information management and reporting program	0.120
- Analysis and forecasting services	0.120
- Investigations program and strategic data procurement	0.160
Northern Australia & The Great Artesian Basin (total)	0.085

Source: (Howard, 2007)

Table 2: Final Summary of Flow Management Options for the Murray River and the Probability of Success

Management Options	**Probability of having a healthy working River Murray System**
Do nothing more (current operations)	LOW
A. Improved operations	LOW
B. Improved operations plus 350 billion litres new environmental flows p.a. (Murray source)	LOW
C. Improved operations plus 900 billion litres new environmental flows p.a. (Basin-wide source)	LOW-MODERATE
D. Improved operations plus 1,630 billion litres new environmental flows p.a. (Basin-wide source)	MODERATE
E. Improved operations plus 3,350 billion litres new environmental flows p.a. (Basin-wide source)	HIGH

Source: (Jones *et al.* 2003)

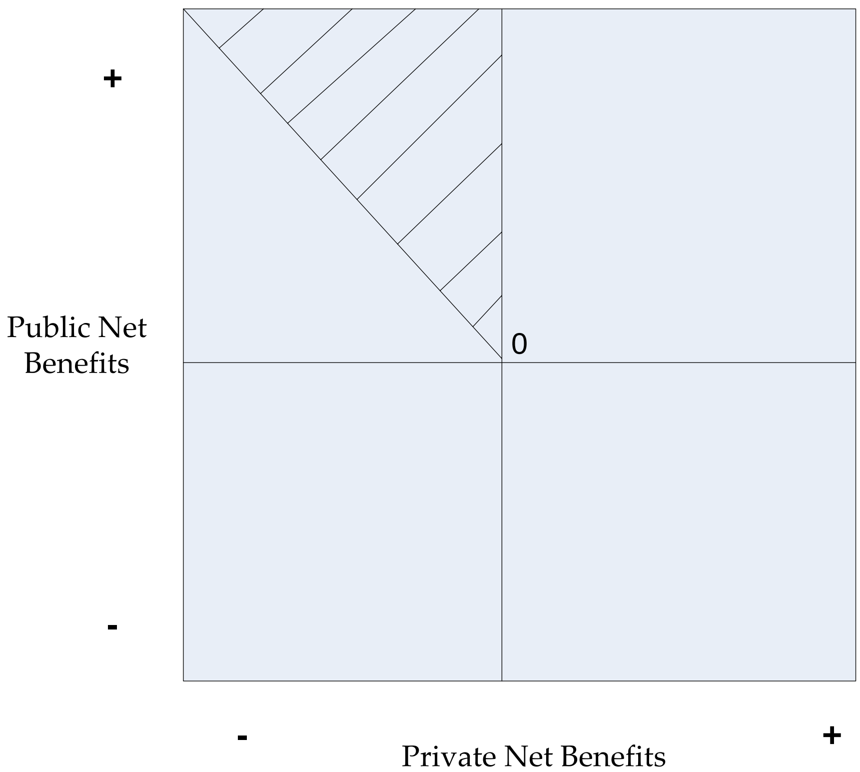

Figure One: Template to Guide Public Investments to Generate Water Efficiency Benefits

Source: Pannell (2006)

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