Navigating water resource sustainability: A risk-based multicriteria analysis of community-identified options driving planning decisions in a declining South Australian water resource

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Key Points

- **Integrated Stakeholder Engagement:** The study used a three-step multi-criteria analysis (MCA) process that deeply integrated community engagement, ensuring community values were reflected in the decision-making
- **Community-Driven Strategy Development:** Strategies for water management were directly derived from community input, ensuring greater buy-in and revealing significant common ground among diverse stakeholders.
- **Risk-Based Probabilistic Analysis:** The technical assessment used a risk-based probabilistic approach, providing a realistic evaluation of management options under uncertainty, crucial for sustainable water planning.

Abstract

Why did you do it: The Marne Saunders Prescribed Water Resources Area (PWRA), a southern Australian catchment, is experiencing declining groundwater & surface water conditions, prompting calls from the community for action. The multiplicity of water uses and values underscores the importance of effective multi-stakeholder engagement and accessing the best available scientific knowledge to enhance the defensibility of water planning decisions.

What did you do: The Landscape Board undertook a three step multi-criteria analysis (MCA) process to rank community-derived options for addressing water resources risks. The first step engaged the community to discover their goals for water resources management and identify potential strategies for achieving these goals. The 2nd step engaged Departmental experts, including scientists and policy analysts to quantify the benefits, risks and trade-offs for each of the proposed options. The 3rd step re-engaged community to review the results of expert analysis and to weight the possible resource condition outcomes and impacts.

What have we learned: When engaged throughout the analytic process, the community found the MCA approach to be transparent and intuitive. The different stakeholder groups discovered that they shared many common values for water resource management. The community particularly appreciated the opportunity for participation having consequential impact upon the findings of the assessment. This, in turn, provided the Landscape Board confidence to act upon the findings of the assessment.

Why does it matter: MCA and risk-based approaches provide a well-established framework for decision-making given conflicting objectives and uncertainty. While appealing from a decision theoretic perspective, achieving acceptable community buy-in with analytic tools can be challenging. This study provides an example of a MCA specifically tailored to maximise the benefits of effective community engagement.

Keywords

Multi-criteria analysis, stakeholder engagement, water planning, probabilistic modeling, community participation, risk management, climate change adaptation.

Introduction

The Marne Saunders Prescribed Water Resources Area (PWRA), a catchment in the eastern Mt Lofty Ranges in South Australia located approximately 70km northeast of Adelaide, experienced an extended period of below average rainfall from 2017 to 2021 causing reduced stream flows and declining groundwater levels. This dry period raised concerns in the local community regarding the capacity of the water resources to sustainably support the economic, social, environmental and Aboriginal water resource needs. In February 2022 the Landscape Board convened a public meeting to address these concerns and it was decided to embark on a more in-depth assessment of risks and potential risk treatment options. The assessment, known as the integrated stakeholder assessment, is the subject of this paper.

The Marne Saunders Prescribed Water Resources Area

The Marne Saunders PWRA encompasses the catchments of the Marne River, Saunders Creek and the underground water within the PWRA boundary. The western half of the catchment comprises undulating steep hills of the Mt Lofty Ranges (the hills zone), while the eastern half comprises a basin with unconsolidated sedimentary deposits having a relatively flat topography (the plains zone). Rainfall is highest in the hills zone, where average annual rainfall is approximately 800mm on the western edge. Rainfall declines rapidly across the escarpment that marks the transition from the hills to the plains zone. The plains are in the rain shadow of the Mt Lofty ranges and have an average annual rainfall of 280mm on the eastern edge (figure 1). The PWRA covers the traditional land and waters of the Peramangk and Ngadjuri people.

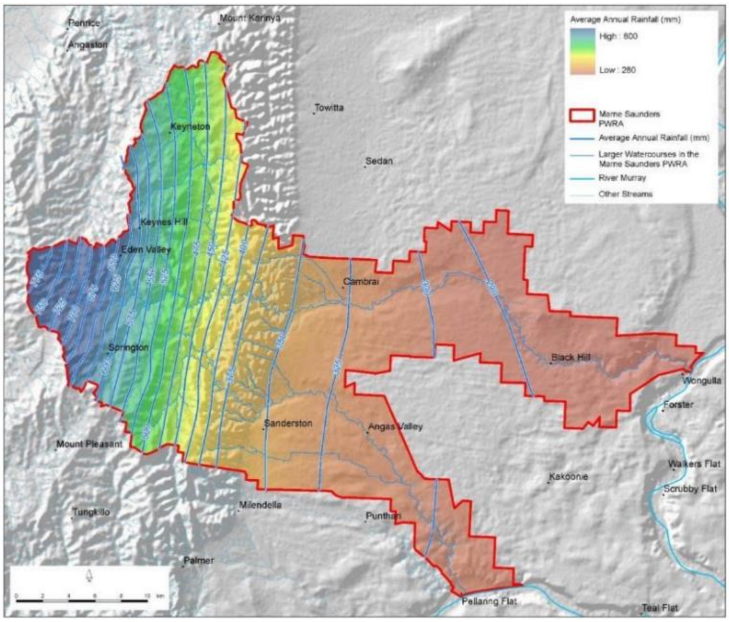

Figure 1. The Marne Saunders PWRA showing annual average rainfall

The PWRA's surface and underground water resources are used for a range of purposes including domestic use, stock, irrigation, industrial, recreation and Aboriginal interest. The Hills zone includes the Eden Valley Wine region, which is known for its high-quality cool climate wines. Other economic activities include dairy, fruit and nuts and grazing. Economic use of water in the Plains zone is almost entirely dependent on groundwater and includes pasture, turf and vegetable production. The total volume of water used for irrigation in 2015-16 was 2,280 ML, with a total of 84 active licences/users at that time. This makes the Marne Saunders one of the smallest prescribed water resources in South Australia according to the number of licences and water use. Nonetheless, these resources support significant economic activity underpinning the livelihoods of the local community while making a valuable contribution to the state's economy.

The PWRA supports diverse water dependent ecosystems reflecting the range of hydrological conditions across the catchment. The hills zone is characterized by a combination of rapidly flowing ephemeral streams and drainage lines, which support pools and riffles in the upper channels, and permanent pools sustained by underground water. The permanent pools provide refuges during dry periods. Aquatic and riparian vegetation, such as River Red Gums, contribute to habitat complexity. Flow variability and structural complexity in the hills support a wide range of species including fish, macro-invertebrates and plants that depend on water availability. The hydro-ecology of the plains zone, having much lower rainfall, is driven by flow events from the hills. Watercourses such as the Marne Alluvial Fan and Lower Saunders are characterized by slower moving water and periods of no flow. Habitats are less diverse with fewer permanent waterholes. Water dependent ecosystems depend on periodic floods and underground water discharge, which sustain critical refuges through subsequent drier periods. Aquifers in the plains zone are recharged almost exclusively by flood events, during which losing stream sections of the watercourses allow underground water replenishment. Similarly, recruitment of river red gums depends on floods to distribute seeds and support germination. The watercourses and pools of the PWRA hosts numerous native and introduced fish species. Key native species include Mountain Galaxias, Carp Gudgeon and the protected River Blackfish.

To ensure the sustainability of water use, the catchment is prescribed in accordance with the *Landscapes Act 2019* (South Australia), which requires that the use of water resources is governed by a Water Allocation Plan (WAP) developed by the Murraylands and Riverland Landscape Board (the Landscape Board). The Marne Saunders WAP was initially adopted by the South Australian Minister for the River Murray in 2010, and was reviewed and amended in 2018 and 2019 (SAMDB NRM Board, 2019).

Integrated stakeholder assessment approach

To assess the water resource risks and the potential benefits of risk treatment options, DEW and the Landscape Board devised a multi-criteria analysis (MCA) assessment approach that was tightly integrated with ongoing community engagement. MCA is a technique from the field of Operations Research that deals with decision making problems in the context of multiple conflicting criteria and objectives (Kiker et al, 2005). It aims to provide a structured framework for evaluating and comparing alternatives while considering the preferences and priorities of stakeholders (Hajkowicz and Collins 2007). The MCA was prosecuted within the framework of a three-step engagement process (Table 1). The initial community engagement (Phase 1) established the community's values and goals regarding the region's water resources and identified preferred options for addressing declining water resource condition. The technical assessment (Phase 2) engaged DEW scientists and policy experts to evaluate the effectiveness of each of the community derived management options in maximizing the community's values for the catchment. In Phase 3, community representatives reviewed the technical assessment and calibrated key criteria to ensure their concerns were addressed.

Table 1. 3 step integrated stakeholder assessment approach

Assessment step	Process
Phase 1: Community engagement	Identify stakeholder values and vision
	Discover ideas and preferences regarding risk management options
Phase 2: Technical assessment	Establish hierarchy of criteria for evaluating risk and benefit of options
	Technical evaluation of options against criteria
Phase 3: Community calibration and review	Stakeholder review and calibration of criteria weights
	Compile final scores and synthesize recommendations

Phase 1: Community engagement

The Landscape Board convened a series of public meetings to communicate the context and purpose of the assessment and provide a forum for the community to voice their concerns and workshop their vision, values and preferred options for addressing the risks posed by declining water resource condition (Table 2).

Table 2. Agenda for Phase 1 community engagement meetings

	Item	Content
1	Introduction	Purpose and context

2	Context	Water resource condition trends and existing planning and policy arrangements
3	Strategic visioning	20 year vision for the catchment: livelihoods, lifestyles, environment, Aboriginal interest
4	Options	Preferred options for achieving vision

Three meetings were held, each targeting a distinct stakeholder group. Meeting 1 included those who use catchment water resources to support their livelihoods, including landholders and representatives from agribusinesses from all parts of the catchment. These stakeholders represented both surface and groundwater use, licensed and unlicensed, hills and plains zones and covered enterprises including vineyards, vegetables, turf cultivation, horticulture, lucerne and livestock. Meeting 2 targeted local residents, businesses and environmentalists who value the catchment water resources for a range of non-commercial purposes contributing to lifestyle. This included both consumptive and non-consumptive use including stock and domestic, aesthetics, environmental values and maintenance of public property and infrastructure. Meeting 3 engaged the Aboriginal interests in the PWRA including the Peramangk people. All meetings were professionally facilitated.

Participants at Meetings 1 and 2 nominated environmental health, stream flows, community strength, catchment restoration and economic opportunity as important values. The engagement yielded a wide range of suggested water planning and management options for addressing water resource condition issues (Table 3). Notably, significant common ground regarding the overall water resource values was established among the diverse individuals and stakeholder groups involved.

The project team synthesized the workshop outputs to identify key parameters and outcomes underpinning criteria for the MCA, particularly relating to desired and undesired outcomes, and establish a well-defined set of options to be evaluated against these criteria. This synthesis involved combining similar options, discarding options deemed unrealistic or unachievable, and providing relevant additional context based on the expertise of water planning officers and science. A total of 15 options and a “business-as-usual” (BAU) scenario (option 0) were identified for further analysis and comparison (Table 3).

Table 3. Synthesis of options for addressing water resources risks and achieving benefits

Id	Community-derived strategy	Implementation example
0	Business as usual	
1	Maintain economic output with less water.	Measures to improve irrigation efficiency
2	Import water to reduce demand on native resources	Piped water from Bolivar WWTP
3	Reduce volume of loss prior to use	Measures to reduce dam evaporation
4	Improve capacity of infrastructure to access allocation	Well deepening
5	Reduce dam capacity	Blanket 20% reduction
6	Return or not capture some portion of runoff	Full implementation of low flow bypass policy
7	Improve microclimate through revegetation	Encourage vegetation of riparian zones
8	Reduce volume taken within existing licensing framework	Reduction of allocations
9	Regulate/reduce water use outside licensing framework	Control stock, domestic, forestry use. Compliance
10	Direct watering of key habitats	Watering pools by solar pumps from aquifer
11	Reduce dam capacity – targeted	Dams having significant hydrological impact only
12	Build relationships with Traditional Owners	Education program, events.
13	Enable freedom of access for Traditional Owners	Freedom of access on private property
14	Environmental water releases	Annual, timed to coincide with natural processes
15	Weed control and cultural burns	

Options 12 to 15 (Table 3) were identified through engagement with Traditional Owners (Meeting 3), while options 1 to 11 are the outcomes of meetings with stakeholders with interests in livelihoods and lifestyle (Meetings 1 and 2).

Phase 2: Technical assessment of options

The assessment comprised a multi-disciplinary expert elicitation engaging science and policy capabilities from the Landscape Board and DEW. Participants included hydrologists, hydrogeologists, climate specialists, ecologists, and planning officers, all of whom brought knowledge and experience specific to the Marne

Saunders PWRA. The technical assessment involved establishing the MCA criteria, estimating benefits and risks of options according to these criteria and then calculating and comparing the final expected value (EV) scores for each option.

MCA Criteria

The assessment team defined a set of criteria related to 3 value domains of catchment water resources (livelihoods, lifestyles and environment), the outcomes within each value domain expected over a future 20 year period and the type and location of the water resources (Table 3). These criteria were designed to ensure adequate representation of stakeholder interests and values and to expose any significant trade-offs that might exist between values, resources and spatial units with regards to the management options. The criteria were arranged in a hierarchy with the total risk and benefit score associated with each option, including BAU, being the weighted sum of the benefit scores for all combinations of spatial unit and value domain.

Table 3. MCA criteria and options

id	Criterion	Options
1	Water resource – spatial units	Hills surface water, Hills ground water, Plains surface water, Plains groundwater
2	Value domain	Livelihoods, Lifestyle, Environment
3	Outcome over 20 year period	5 Outcomes for each value domain. Worst case to best case

Spatial units

The location of the water resource within the catchment and the type of resource are fundamental parameters affecting water dependent values and the response to proposed management options. For this assessment, location and type of resource are considered together as a spatial unit in the criteria hierarchy (criteria 1). Location includes the Hills and Plains zones while resource type includes surface and underground water giving a total of four spatial units (Table 3).

Value domains

The benefits of options were assessed across three value domains (Table 3). **Livelihoods** represents the direct economic benefits from consumptive use of water to support business activities, and includes irrigated agriculture, livestock, intensive agriculture, and any other uses for the purpose of making money. **Lifestyles** represent the value of water for supporting non-commercial societal values and needs, including domestic use, public places, maintenance of infrastructure and general amenity and visual appeal. **Environment** represents the water dependent ecosystems of the PWRA including the status of ecosystems.

Outcomes for value domains

Five potential outcomes were defined for each of the three value domains (Table 4). These cover all possible outcomes for a value domain in a given spatial unit over a future 20-year period from worst case through to the best-case scenario. Criteria for each outcome level for each value domain were based on the community's vision and values for the native water resources determined through the Phase 1 engagement as well as from existing policy and planning documents such as the Marne Saunders Water Allocation Plan. These criteria aim to represent measurable and observable features related to each value domain. They are limited to the range of outcomes that are deemed plausible or achievable in order to maximize the sensitivity of the criteria to the hydrological impact of the proposed options.

Table 4. Summary of outcome criteria – livelihoods, lifestyles and environment

Outcome	Livelihoods	Lifestyles	Environment
Best case	Improved water availability, all allocations can be taken, economic opportunities for all stakeholders, Net >30% improvement in GVIAP	No interruptions for the following: Domestic supply, Public parks, Public infrastructure. Improved visual amenity, improved vegetation health	Significant improvement in species diversity, range, population numbers for all indicators. Redgums in good condition with moderate to strong recruitment.
Good	Current level of economic	As above, however **minor**	Stabilisation of populations of

	development is supported with some potential for expansion. Small uniform benefit (10-30% increased GVIAP) or limited to some sectors.	**interruptions expected**	threatened species. Increased recruitment of riparian vegation. Redgums in moderate to good condition with some recruitment
Intermediate	Similar water availability as per last 20 years with significant year to year variability. No significant economic benefits or losses compared to current.	More frequent interruptions expected for two of the following: Domestic supply, Public parks, public infrastructure. Improved visual amenity, improved vegetation health	Low population densities of fish, few sensitive flow responders in refuges. Redgums in moderate condition with little recuitment
Poor	Reduced water availability causing 10-30% decrease in GVIAP, although patchy with some sectors hit harder than others.	Water is not available for desired community lifestyle. Restrictions in place. All of the following experience significant reductions: Domestic supply, Public parks, Public infrastructure. Improved visual amenity, improved vegetation health	Loss of threatened species including Galaxids and flow-sensitive macroinvertebrates. Redgums in poor condition and no recruitment.
Worse case	Reduced water availability driving significant financial losses across the board. >30% decrease in GVIAP.	Water is severely restricted for desired lifestyle (multiple restrictions). All of the following experience significant reductions: Domestic supply, Public parks, Public infrastructure. Improved visual amenity, improved vegetation health	Loss of all permanent pools. Loss of redgum populations on floodplain. Few trees left and no self-perpetuating population.

Exclusions

The project considered Aboriginal interest as a separate value domain, which is defined as the interests of First Nations peoples that fall outside of the livelihoods, lifestyle and environment value domains. Benefits and risks of options related to this value domain were considered in a separate assessment process and were therefore not specifically modelled by this MCA. However the four management options proposed through the First Nations engagement were evaluated against the livelihoods, lifestyles and environment value domains defined by this MCA as well as through the Aboriginal interest assessment process.

This MCA did not include criteria related to the cost or practicality of implementing the proposed options. This is consistent with the purpose of this assessment, which was to identify management options that could deliver benefits and reduce risks for the widest range of stakeholders and outcomes. The feasibility of potentially beneficial options is addressed by a subsequent assessment process.

Estimation of benefits and risks

An expert elicitation process estimated probability distributions of outcomes over a future 20-year time period for each combination of criteria (i.e. option, spatial unit, and value domain). A key challenge was the large number of combinations of options, criteria, and value domains. To address this dimensionality, the assessment team adopted a three-step process to ensure the most efficient use of available knowledge. In the first step, experts identified the key factors and principles underpinning the assessment and assessed selected examples as case studies. Following this, the core assessment team analysed the options according to the agreed principles and examples. Finally, the assessment results were reviewed by broader expert group.

Analysis of a given option and criteria set involved a facilitated discussion of the relevant factors and culminated in estimation of a probability distribution of outcomes, with each participant recording probability estimations individually. While the benefits of options were assessed separately for each spatial unit, a key element of context includes the interdependencies between the spatial units. There are significant surface water-underground water interactions affecting processes such as the recharge of aquifers, maintenance of permanent pools and flow regimes and surface water quality. Similarly, the hydrology of the Plains is significantly affected by flows from the Hills zone, which means that management targeting hydrology in the Hills zone could have consequences for both the Hills and the Plains. Principles regarding these interactions were developed and considered through the expert elicitation process.

Participants' estimates were combined for each option by averaging. This approach was intended to facilitate reasoning with uncertainty while controlling for the bias and variance inherent in the expert elicitation process. The final output was a table of results comprising 192 rows (i.e. four spatial units, three value domains, 16 options) with each row recording the combined participant assessments. Table 6 shows an excerpt of the results for the Environment value domain over a future 20-year period given a business-as-usual management scenario. For this case it was determined that intermediate to poor outcomes are most likely for all spatial units given this scenario. Note that the likelihoods sum to 1.

Table 6. Combined likelihood distribution – Business as usual, Hills Surface water

Option	Spatial unit	Value domain	Best case	Good	Intermediate	Poor	Worst case
0 BAU	Hills surface water	Environment	0	0.18	0.49	0.31	0.02
	Hills groundwater		0	0	0.75	0.25	0
	Plains surface water		0	0	0.22	0.59	0.19
	Plains groundwater		0	0	0.76	0.24	0

Weighting and calculation of EV

A key step for MCA is to weight criteria to account for differences in importance related to the decision problem. Consistent with the context of water planning in South Australia, the spatial sub-units and value domains are equally weighted to ensure that stakeholders, values, and resources are treated equitably.

The five outcome levels for each value domain were weighted to reflect the relative value or benefit of each outcome, with the best-case outcome receiving the highest weight and the worst case the lowest weight. For the sake of efficiency, a relative scale was used to weight these levels in accordance with the Analytic Hierarchy Process (AHP) (Saaty, 1982). Outcomes were weighted relative to each other on a ratio scale, meaning that, for example, an outcome having a score of two is regarded as having twice the value as an outcome scoring one. As a starting point, the assessment team applied standard weightings derived from AHP practice, with worst case = 1, poor = 3, intermediate = 5, good = 7 and best case = 9. These weights were reviewed by community representatives in Phase 3 of the assessment.

Finally, the total score for each option and scenario was calculated as the weighted sum of individual scores for outcomes, value domains and spatial units. As this assessment uses a probabilistic approach, the objective function is Expected Value (EV), which is a statistical concept that quantifies value given uncertain conditions. EV was calculated as the weighted sum of the Performance Values (PV) of an option for all criteria, where PV is the weighted sum of probability and value across the five outcome levels (i.e. worst case through to best case). The EV values for the options were then normalised so that the scores for BAU scenarios are 1 and the scores for the options are a ratio of the BAU benchmark. This means that options achieving a score greater than 1 demonstrate net benefit while options having a score less than 1 represent a net risk.

Phase 3: Community review and calibration

The assessment team held two workshops with a group of community representatives to review preliminary results and weight the outcome criteria for each of the three value domains. The calibration process was carried out with the aid of spreadsheet functions to provide an interactive display of the impact of weighting decisions on the EV of options. Accordingly, the community reference group made changes to the default weighting of outcomes for all three value domains (Table 7). They considered the Poor scenarios for livelihoods and environment almost as bad as the Worst Case scenario and weighted accordingly. Also, they regarded a Good outcome for environment the same as Best Case. The group was assured that the outcome weighting process did not apply unintentional weightings across value domains or spatial units.

Table 7. Community derived weightings for outcomes

Value domain	Worst case	Poor	Intermediate	Good	Best case
Livelihoods	1	1.5	5	7	10
Lifestyle	1	3	5	6	8
Environment	1	1.2	5	10	10

The assessment approach and preliminary results were well received by the community representatives. They appreciated the opportunity to weight the MCA model to match their preferences and values and they found the assessment deliverables, including quantitative comparison between options (i.e. in addition to rank order) and exploration of key trade-offs, intuitive and useful.

Results: Options Scores and rank

The assessment produced a final rank order of options according to each option's 'Expected Value' (EV) (Table 8). All but one option achieved a net benefit relative to BAU. Options 11 and 7 were assessed as providing very significant net benefit relative to BAU (34% and 23% higher EV respectively), while option 4 provides very little net benefit and option 9 indicates a slight net disbenefit (2% lower EV).

Table 8. Rank order of options by EV

Rank	ID	Community-derived strategy	Implementation example	Expected value*
1	11	Reduce dam capacity – targeted	Dams having significant hydrological impact only	1.34
2	7	Improve microclimate through revegetation	Encourage vegetation of riparian zones	1.23
3	10	Direct watering of key habitats	Watering pools by solar pumps from aquifer	1.19
4	14	Environmental water releases	Annual, timed to coincide with natural processes	1.14
5	2	Import water to reduce demand on native resources	Piped water from Bolivar WWTP	1.13
6	5	Reduce dam capacity	Blanket 20% reduction	1.11
7	6	Return or not capture some portion of runoff	Full implementation of low flow bypass policy	1.1
8	15	Weed control and cultural burns		1.08
9	8	Reduce volume taken within existing licensing framework	Reduction of allocations	1.07
10	3	Reduce volume of loss prior to use	Measures to reduce dam evaporation	1.06
11	12	Build relationships with Traditional Owners	Education program, events.	1.05
12	1	Maintain economic output with less water.	Measures to improve irrigation efficiency	1.05
13	13	Enable freedom of access for Traditional Owners	Freedom of access on private property	1.05
14	4	Improve capacity of infrastructure to access allocation	Well deepening	1.01
15	9	Regulate/reduce water use outside licensing framework	Control stock, domestic, forestry use. Compliance	0.98

* *Expected values are expressed in a ratio scale, with values greater than one representing a net benefit and values less than one a net disbenefit compared to the baseline (business as usual).*

The MCA produced some unexpected results. For example, despite the potential for delivery of up to 3.2 GL p.a. at the top of the catchment through the proposed Barossa New Water Strategy, importation of water/ accessing new water sources (option 2) produced less net benefit that the highest ranked option (reduced dam capacity – targeted, option 11) (EV = 1.13 vs 1.34) . Also noteworthy is that option 8 (reducing water allocations) produced limited net benefits (7% higher than BAU) likely due to many users not currently using their full allocation.

Figure 2 provides an example of how the MCA can facilitate further examination and comparison of the key factors underpinning EV. It compares a breakdown of scores by criteria for 3 contrasting options. The horizontal axis in each chart represents the baseline EV for BAU, and the deviation above or below is proportional to the estimated positive (above baseline) or negative impact (below baseline) according to the criteria examined. It shows that strong environmental and lifestyle benefits across all spatial units contribute to the top scoring option (option 11, Figure 2 A), despite a negative effect on livelihoods in the Hills Surface Water resource due to reduced water security. The worst performing option (option 9, Figure 2 B) indicates that small improvements in environmental outcomes are more than offset by impacts to livelihoods caused by additional regulation of stock use. Importing water (option 2, Figure 2 C) achieved less benefit than expected because benefits were mostly attributed to a single value domain and spatial unit (livelihoods, hills surface water) whereas higher ranked options achieve benefits spread across more criteria.

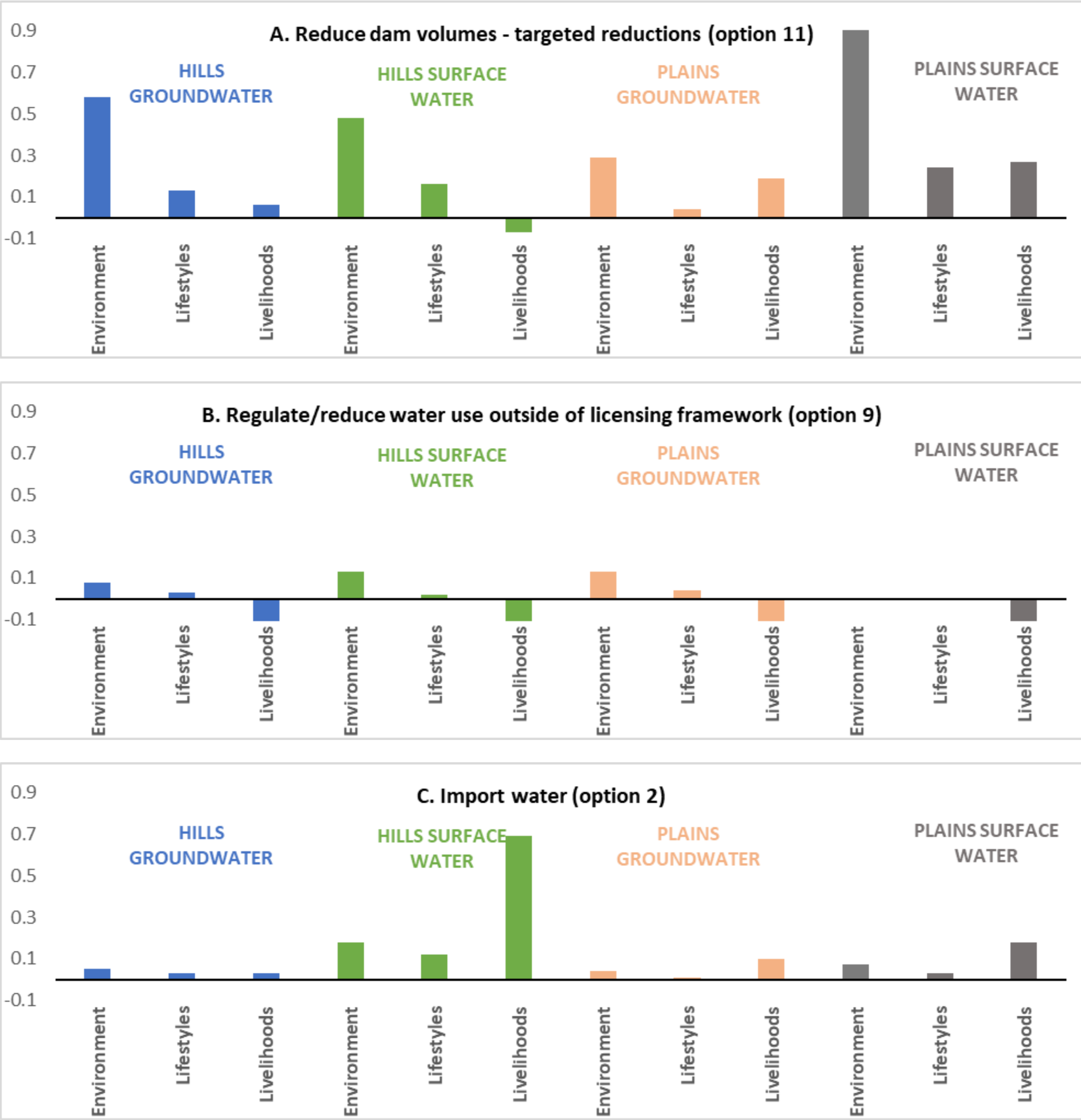

Figure 2. EV, expressed as deviation from 'Business as usual' per value domain and spatial unit, for management options: reducing dam volumes via a targeted approach (a); regulating stock and domestic use / increasing compliance (b), and Importing water (c)

Discussion and Conclusion

Water resource planning is inherently challenging due to the need to balance a range of interests and values, account for known climate variability and address uncertainties regarding resource capacity and water dependent ecosystems. These challenges are further compounded by the impacts of a changing climate and the potential need for more far-reaching interventions to respond to altered assumptions regarding resource sustainability. To arrive at policy and management interventions that maximize overall benefit while minimizing negative trade-offs, it is essential to identify and consider a broad range of factors in a transparent and structured way.

The present study addressed these challenges by tightly integrating a multi-stakeholder engagement process with a MCA. The objective function, criteria, and proposed management options and key model weightings for the MCA were drawn from engagement with the community at key points through the assessment process. The expert elicitation approach was structured to address the large number factors affecting water resource planning outcomes. The assessment was “risk-based” in that it adopted a probabilistic approach to determining the benefits and risks associated with the management options similar to DEW’s water resource plan risk assessments (e.g. DEW 2019). This encouraged technical experts to reason with the inherent uncertainties of the problem domain leading to a more realistic assessment in the context of limited data and knowledge.

The outcome of the assessment was an MCA that was calibrated to be sensitive to the values and vision for catchment water resources that the community care about and which was explicit regarding the potential trade-offs associated with management options. Additionally, it was found that the engagement process itself highlighted common values and goals across interest groups. This level integration of community engagement and values with a technical assessment of risks and benefits is unprecedented in the South Australian water planning context. These factors provide decision makers with increased confidence when it comes to difficult decisions in the context of potentially competing interests.

Community visioning responses: goals for the catchment

A key finding of this engagement was that the three participating stakeholder groups (First Nations, Licensees and non-Licensees) held similar goals for the catchment. They all valued environmental outcomes and resource management outcomes that enabled a thriving community. This is an important finding insofar as decision making for the catchment is concerned since, prior to this engagement, it was widely understood that differing stakeholder groups had little in common. It is hoped that a more cohesive approach to water planning in the catchment may be possible owing to this uncovering of so-called common ground through this analysis / engagement.

Similarly, questions posed at the initial community meetings designed to elicit the community’s preferences for potential strategies for reaching those goals yielded a large proportion of identical approaches across the three disparate groups. As indicated above, this further demonstrated a cohesiveness within the community not previously observed. It is important to note that the process demonstrated here - whereby potential strategies for addressing concerns felt by the community were garnered from the community directly - was key to the community’s buy-in and acceptance of the overall assessment. Rather than taking a set of potential policy options to the community for discussion and deliberation, following a degree of educative effort regarding scientific and policy-related matters, the community’s ideas were subjected to rigorous scientific assessment. This process of community elicitation to arrive at potential policy ideas to address concerns over a water resource is novel and has been shown to be a valuable methodology to undertake.

The MCA approach

A benefit of this integrated stakeholder assessment is that the relatively sophisticated nature of the MCA process contributes to transparency of decision making for water planners. This is because in addition to providing a rank ordering of options, it calculates relative performance, and documents the rationale for the estimated performance of options and exposes key trade-offs. Transparency regarding trade-offs is critical in any multi-stakeholder engagement process as it helps participants to negotiate in good faith.

A key benefit of the three-phase assessment is that it provided the community confidence that the expert assessment process was sensitive to their needs and values despite the inherent differences between interest groups regarding some values. It was found that once the community understood that the assessment would address their preferred management options and be calibrated according to their values that they trusted Departmental experts to develop the decision-making framework and undertake the technical assessment work. It is hoped that such transparency helps to alleviate an inherent suspicion of government decision making as expressed by some community members early in the engagement process.

The outcomes of this work were presented to the Landscape Board, who valued the emphasis on community participation and technical rigour. The Board appreciated that the proposals for management options were provided by the community themselves and were assessed through expert analysis in the context of an established decision theoretic framework. The assessment successfully demonstrated that there are opportunities to improve outcomes for water dependent values in this catchment. This prompted a decision to review water policy in the PWRA with an emphasis on further investigation of the options addressed by this work. The authors believe this methodology could be employed in other jurisdictions as both a policy review tool and a community engagement vehicle.

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