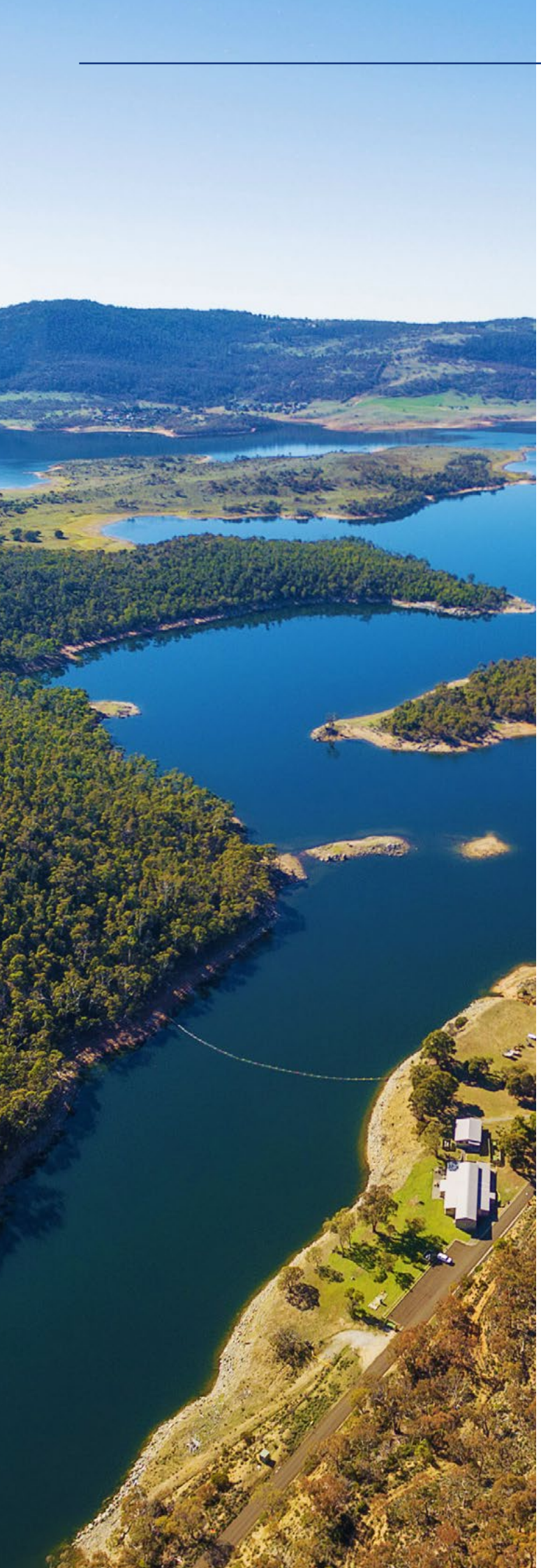
Department of Climate Change,
Energy, the Environment and Water

About the guidelines

Extracted from the Water conservation cost-benefit analysis guidelines

September 2024

NSW GOVERNMENT



The *Water conservation cost-benefit analysis guidelines* have been developed to provide a framework to undertake cost-benefit analysis of urban water conservation options. These guidelines will assist utilities to consider the broad range of costs and benefits of water conservation initiatives. Their purpose is to encourage utilities to consider and evaluate water conservation initiatives on an equal basis with supply side measures that improve water security.

For ease of use, the full *Water conservation cost-benefit analysis guidelines* have been broken into the following sections to guide utilities through the analysis process:

- **About the *Water conservation cost-benefit analysis guidelines*** – Summary of the purpose, background and process for conducting a cost-benefit analysis.
- **Undertaking a cost-benefit analysis** – Describes the steps involved.
- **Valuation methodologies** – A successful analysis will assess economic, social, environmental and cultural costs and benefits.
- **Case study A** – Water conservation cost-benefit analysis in a metropolitan coastal community with a large population.
- **Case study B** – Water conservation cost-benefit analysis in an inland community with a small population.
- **Case study C** – Water conservation cost-benefit analysis in an inland community with a mid-size population.

Visit **water.dpie.nsw.gov.au** to download these documents or a copy of the full *Water conservation cost-benefit analysis guidelines*.

Contents

Executive summary

1

Water conservation measures are a key element in balancing water system supply and demand to meet community water security needs across NSW[1]. They include programs to enhance water efficiency, leakage management, and small-scale water reuse and contribute to the community's liveability and environmental objectives.

The *NSW Water Strategy* says communities, businesses, and other tiers of government strongly support water conservation to improve the resilience of water supply systems and "delay the timing and reduce the scale of investment in new supply infrastructure". We would otherwise require new infrastructure to manage growth and our variable climate in meeting the community's water security needs.[2]

The value of water conservation varies over time and location. It is dependent on hydrological conditions, current and future infrastructure systems, and other economic, social, and environmental factors. Identifying where and when it provides value to the community, the impactors and beneficiaries of these measures, and potential sources of funding requires sound evidence and an adaptive analytical framework. In this context, the NSW Government's *Water Efficiency Framework* provides guidance for stakeholders implementing water efficiency initiatives.[3]

Sydney Water, Hunter Water, and the Central Coast Council primarily deliver water conservation in major metropolitan NSW. More than 92 local water utilities provide services to customers across the remainder of NSW. There are significant differences in size, location, governance and economic regulatory arrangements that apply to these water utilities.

This contributes to differing capabilities and incentives to identify, evaluate, and deliver water conservation measures alongside other measures to manage water security and meet community objectives.

The *NSW Water Strategy* notes the uptake of water conservation, particularly in metropolitan NSW, has plateaued. This generates concerns that policy, regulatory, and institutional factors are impeding the potential for investment in water conservation. Extracting the most from existing assets was a key theme in the NSW Productivity Commission's *Kickstarting the productivity conversation* report. The commission sought stakeholder comment on ways in which the NSW Government could achieve greater water use efficiency, particularly in metropolitan NSW.[4]

The NSW Government has an important role to play in ensuring water utilities have the necessary capabilities and processes required to evaluate water conservation measures. This includes using standard cost-benefit frameworks consistent with broader NSW Government guidance[5]. To support this, the then NSW Department of Planning and Environment engaged Frontier Economics to develop cost-benefit guidance and catalogue input assumptions to support urban water conservation decisions (framework).

1 Water security is generally described in terms of frequency, duration, and severity of water restrictions (primarily related to drought) and likelihood of supply shortfall events (in and outside drought).
2 NSW Water Strategy, Priority 6: See website: water.dpie.nsw.gov.au/plans-and-programs/nsw-water-strategy/toward-2050/priority-6
3 The NSW Water Efficiency Framework seeks to provide clear steps to design, deliver and review water efficiency programs. See website: water.dpie.nsw.gov.au/our-work/projects-and-programs/water-efficiency/framework
4 NSW Productivity Commission, Kickstarting the productivity conversation, 2019, p62
5 Such as NSW Treasury's *NSW Government Guide to Cost-Benefit Analysis (2023)* and Department of Planning and Environment's *Regulatory and Assurance Framework for Local Water Utilities (2022).*

Cost-benefit analysis (CBA) is a standard and well-accepted tool for systematically assessing the economic, social, and environmental costs and benefits that accrue to the community of options to address a business need or opportunity. It differs from traditional financial analysis that provides a narrow cash-flow focus to investment decision-making from the perspective of the customer or utility. CBA can also help identify the distribution of this economic, social, and environmental value across the community, which can assist in identifying beneficiaries to inform funding discussions.

We can readily apply CBA to water conservation and broader integrated water cycle management decision-making including water security. This could take the form of:

- evaluating individual programs using a simple CBA
- using more complex forms of CBA, such as real options analysis or adaptive pathways analysis. These evaluate baseline investment in water conservation that maintains capabilities and enhances the ability to scale up during times of drought – the "availability value" of water conservation.

Whether simple or complex, CBA can support decision-making. It requires proponents to be clear about the objective, the potential options for achieving the objective, and the transparent and objective evaluation process comparing these options.

We hope this framework can enhance the consistency and quality of CBAs that support water conservation decision-making. We support cost-benefit guidance with a set ("catalogue") of input assumptions for use in quantifying costs and benefits with associated evidence[6] and three detailed worked examples (case studies) with Excel-based CBA calculations and results.[7] We have developed this framework for utilities to apply "fit for purpose" given the specifics of their business need, the potential options, and their impact on the community.

Frontier Economics worked closely with the department and a range of local water utilities to refine the scope of this guidance material. We aimed for the right balance between the economic concepts, practical guidance, and, where possible, NSW-specific context. During this process, it became clear there are other supporting actions capable of enhancing water conservation decision-making.

This guidance may:

- Enhance industry capacity to undertake CBA. This includes collecting information, and developing consistent assumptions and valuation methodologies such as approaches and template models to estimate the value of water and calculate avoidable costs.
- Address governance issues such as responsibility and accountability gaps[8] and ensure consistent strategic planning processes across the water cycle. This includes assessing the coordination of water conservation, large-scale wastewater or stormwater recycling, and other climate-independent supply.
- Address other funding and investment barriers. This includes access to baseline funding and resourcing to retain skills that enable programs to scale up when water conservation value is high.
- As acknowledged in the NSW Water Efficiency Framework, water conservation programs form part of a broader portfolio of measures to manage water security for communities across NSW. These programs are sometimes evaluated independently, and other times alongside supply planning.

6 Department of Climate Change, Energy, the Environment and Water (2024), Catalogue of values for costs and benefits of water conservation.
7 Department of Climate Change Energy, the Environment and Water (2024), Case studies A-C, extracted from the *Water conservation cost-benefit analysis guidelines*.
8 See for example, findings of the Audit Office of NSW, Auditor-General Report to Parliament, *Water conservation in Greater Sydney*, 2020, p. 2.

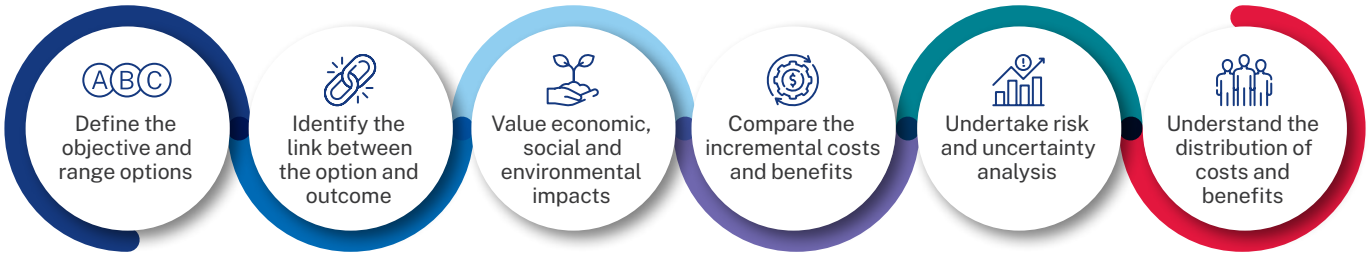
1.1 Purpose

The then Department of Planning and Environment engaged Frontier Economics to help develop guidance material to support cost-benefit analysis of urban water conservation decisions across NSW consistent with best-practice and relevant jurisdictional cost-benefit analysis guidelines[9].

This framework material includes the following:

- A set of guidelines outlining the process for applying the 6 steps of cost-benefit analysis to water conservation measures (see **Figure 1**) (this document). Within each of these steps, these guidelines cover the:
  - key concepts and issues in applying cost-benefit analysis to water conservation decisions drawing on the standard principles and processes articulated in NSW Government cost-benefit analysis guidelines
  - practical "do and don't" tips as well as examples of valuation methodologies
  - overview of the 3 case studies and other worked examples
  - checklist of steps and processes for user to consider before completion.
- A set ("catalogue") of input assumptions for use in quantifying costs and benefits with associated evidence.[10]
- Three detailed worked examples (case studies) with Excel-based calculations and results.[11]

Figure 1: Six broad steps to cost-benefit analysis



1.2 Audience

This framework seeks to support practitioners undertaking CBA to identify the value of water conservation measures. Practitioners can apply the framework to a range of governance or investment decisions covering water efficiency, leakage management or small-scale water reuse. It either complements or replaces other measures to manage water security and meet other community objectives.

We designed the framework to accommodate a range of audiences. This includes those looking for an accessible overview that may not regularly involve a CBA.

For this reason, the guidelines provide a high-level and detailed articulation of CBA to ensure they are useful for a range of audiences. For example, if you are a:

- project director looking for a high-level understanding of CBA, see **Executive summary**, **Introduction** and **Getting started** sections
- project manager looking to understand the key components of a CBA and the level of resourcing required including expert assistance, see **Getting started** and the checklist below (**Table 1**)
- practitioner looking for a step-by-step guidance or "instructions" to undertake CBA or review CBA, see the remainder of this document and the Excel-based CBA model workings for each case study.[12]

9 Such as NSW Treasury's NSW Government Guide to Cost-Benefit Analysis (2023) and Department of Planning and Environment's *Regulatory and Assurance Framework for Local Water Utilities (2022)*.
10 Department of Climate Change, Energy, the Environment and Water (2024), Catalogue of values for costs and benefits of water conservation.
11 Department of Climate Change Energy, the Environment and Water (2024), Case studies A-C, extracted from the *Water conservation cost-benefit analysis guidelines*.
12 Department of Climate Change Energy, the Environment and Water (2024), Case studies A-C, extracted from the *Water conservation cost-benefit analysis guidelines*.

1.3 Summary of requirements

- Practitioners can use CBA in a variety of contexts to inform the evaluation of strategies and/or specific projects as well as government decision-making related to funding and prioritisation processes.
- **Table 1** provides a checklist to apply when undertaking CBA. Match the extent of analysis undertaken for each CBA to answer these questions to the size, complexity, level of risk, and estimated cost on a case-by-case basis.

Table 1: Economic analysis and distributional analysis checklist

Does the analysis:	
✓	Clearly define the "problem" and objective of the project?
✓	Include a base and a range of options that achieve the objective?
✓	Consider the broad set of economic, social, and environmental impacts across the community, including any impacts beyond the local community that may accrue to the broader NSW community?
✓	Forecast relevant economic, social, and environmental costs and benefits – relative to the base case – across the community over an appropriate modelling or appraisal period?
✓	Evaluate the options from a consistent starting point and account for the project's full lifecycle over the modelling or appraisal period?[13]
✓	Use 5 per cent discount rate as a central assumption?
✓	Account for impacts that cannot be quantified qualitatively?
✓	Include tools for assessing the impact of risk and uncertainty on the costs and benefits?
✓	Aggregate the incremental costs and benefits of the options into an overall measure of net benefits to the community (for example, NPV and BCR)?
✓	Identify the high-level distribution of costs and benefits across the community including those bearing costs and receiving benefits?
✓	Appropriately document options considered, key assumptions (including sources or references), CBA results and limitations, and next steps?

13 If the modelling period is less than the asset life, there are techniques such as incorporating a residual value to account for the ongoing benefits that an asset provides beyond the still CBA modelling period. This may be a result of the asset still producing benefits or because it can be resold.

Introduction

2

Key points

- Water conservation programs include measures to enhance water efficiency through behaviour and/or technology, manage leakage, and promote small-scale supply and reuse. All these measures ultimately reduce the draw on the community's water supplies. Some of these measures also reduce use of the wastewater or stormwater systems.
- Water conservation initiatives are one part of the portfolio of options a utility can use to manage water security. It is therefore critical that sound evidence and an adaptive analytical framework guides decision-making and identifies water conservation measures that provide value for money for communities across NSW.
- Cost-benefit analysis (CBA) is an economic tool to guide this decision-making to identify where and when water conservation measures can deliver *additional* or *incremental* value or net benefits to the community.
- CBA compares the economic, social, and environmental costs and benefits of different options and converts it to a single monetary (dollar) metric.
- CBA is the preferred approach for the economic evaluation of all policy, investment, or regulatory decisions. However, the extent of analysis undertaken for a CBA should match the size, complexity, level of risk, and estimated cost on a case-by-case basis. Not all CBAs need to be complex. However, they all should follow a basic set of steps to ensure a systematic assessment of the costs and benefits of a range of options available to address a business need or opportunity.

The aim of these guidelines is to provide an accessible and user-friendly set of "instructions" to undertake a CBA to demonstrate the value of water conservation. The guidelines draw on the standard principles and processes for CBA articulated in NSW and Australian Government CBA guidelines and applies them to water conservation in the NSW context.[14] Use the guidelines in conjunction with the supporting catalogue of values.

14 NSW Treasury, *NSW Government Guide to Cost-Benefit Analysis*, TPG23-08, 2023, p. 38.

2.1 Background

Population growth, drought, and the potential long-term impacts of climate change present significant challenges to securing water supply in NSW. Efficient investment in, and use of, water are key elements in balancing supply and demand and providing water security in a cost-effective and sustainable manner. This includes in a way that is resilient to key uncertainties on the:

- **demand side** – future population, climate, housing type, community expectations for urban space such as irrigating the urban canopy to promote cooling, irrigating open space for enhanced recreation opportunities, and water in the landscape for amenity purposes
- **supply side** – rainfall and dam inflows and purified recycled water to augment drinking water supplies, the cost of major water investments.

2.1.1 What is water conservation?

The *NSW Water Strategy* (Strategy) is the NSW Government's integrated approach to looking after the state's water resources. The Strategy sets the direction for water service delivery and resource management in NSW over the long-term.

The Strategy identifies water conservation as a key focus, and the NSW Government has committed to supporting and investing in water conservation across all sectors.

> The role of water conservation should have equal standing with additional supply side options when balancing supply and demand to ensure water is being used efficiently before imposing costs on the community for additional water infrastructure[15].

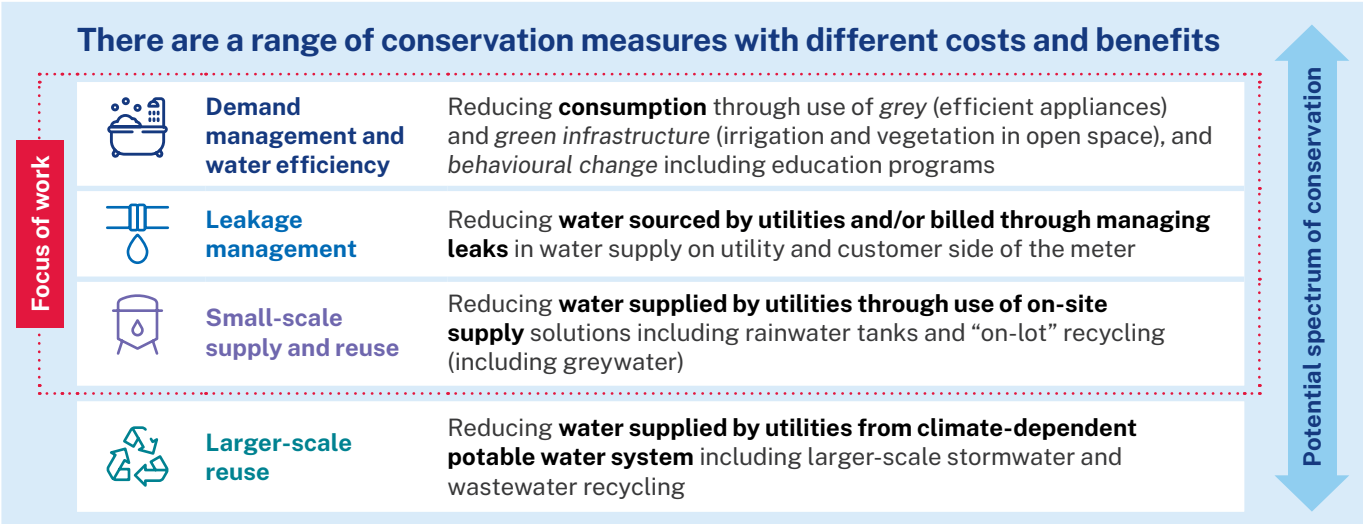
Water conservation can refer to a range of measures to enhance water efficiency through changing behaviour (demand management) and/or technology, manage leakage, and promote small-scale supply and reuse.

While there is no single definition, as shown in **Figure 1**, for the purposes of these guidelines we focus on:

- water efficiency through behaviour and/or technology
- leakage management
- small-scale supply and reuse.

We have not included temporary water restrictions as a water conservation measure, but please note, we now capture what were often called "permanent water restrictions"[16] as part of the "water efficiency" component of water conservation.

Figure 2: What is water conservation?



15 NSW Government, NSW Water Strategy, August 2021, p118.

16 For example, Sydney Water's *Water Wise* Guidelines *"which we used to call 'water restrictions', are the simple, commonsense things that we all need to do, every day, year-round, to help save water across Greater Sydney. Everyone has a responsibility to be water wise. Water Wise Guidelines apply to all residents and businesses in Sydney, the Blue Mountains, and the Illawarra."* See website here: www.sydneywater.com.au/water-the-environment/what-we-are-doing/water-wise-guidelines.html

Water conservation can lead to a range of benefits. These include avoiding the costs of managing the water system, such as avoiding drought-related costs, and in some cases the wastewater or stormwater systems. These cost savings are known as "avoided or avoidable costs" and benefit the community. These benefits can be large on a unit basis (that is, $/kL) in systems nearing capacity even if water conservation measures are relatively small-scale.

Many of these benefits extend beyond the water business and its direct customers to generate broader economic, social, and environmental outcomes for the community. For example, water conservation can also generate environmental improvements. This includes reducing the need for water extraction from, and/or wastewater or stormwater discharge into, local water bodies.

Other environmental benefits derive from reduced greenhouse emissions from energy use associated with water supply and wastewater management.

However, the value of water conservation varies over time and location. It is dependent on hydrological, infrastructure systems (existing and potential future), and other economic, social, and environmental factors. Most stakeholders including the NSW Government, the Independent Pricing and Regulatory Tribunal (IPART), and the Productivity Commission acknowledge that water conservation measures should be evaluated and then only delivered where and when they provide value to the community, that is, where the incremental benefits outweigh the costs (see **Box 1**).

Identifying where and when water conservation provides value to the community requires sound evidence and an adaptive analytical framework.

Box 1: Why is water conservation efficiency important?

It is important to focus on "efficient" or "value for money" water conservation measures, because while they can offer significant benefits to the community, they can be costly relative to alternatives.

In some circumstances, water conservation can lower the cost of providing water and improve the environmental and social outcomes relative to other solutions. For example, in water, wastewater, or stormwater systems nearing capacity, water conservation can defer measures – even if relatively small-scale – the community would otherwise incur to meet levels of service. In these circumstances, it results in "avoidable costs". In these cases, water conservation is considered efficient if the incremental benefits outweigh the incremental costs – providing net benefits to the community provides value for money.

However, this is not always the case. In some circumstances, the expense of a water conservation measure will outweigh its benefits, and there may be other measures better placed to achieve social and environmental outcomes. For example, in some circumstances the "avoidable cost" benefits of water conservation may be limited if there is sufficient capacity in existing drinking water or wastewater networks without the need for significant augmentations for some time. In this circumstance, the incremental costs associated with water conservation – relative to a business-as-usual or traditional option – may exceed the incremental benefits. In such cases, water conservation may not be efficient. In providing net costs to the community it does not provide value for money.

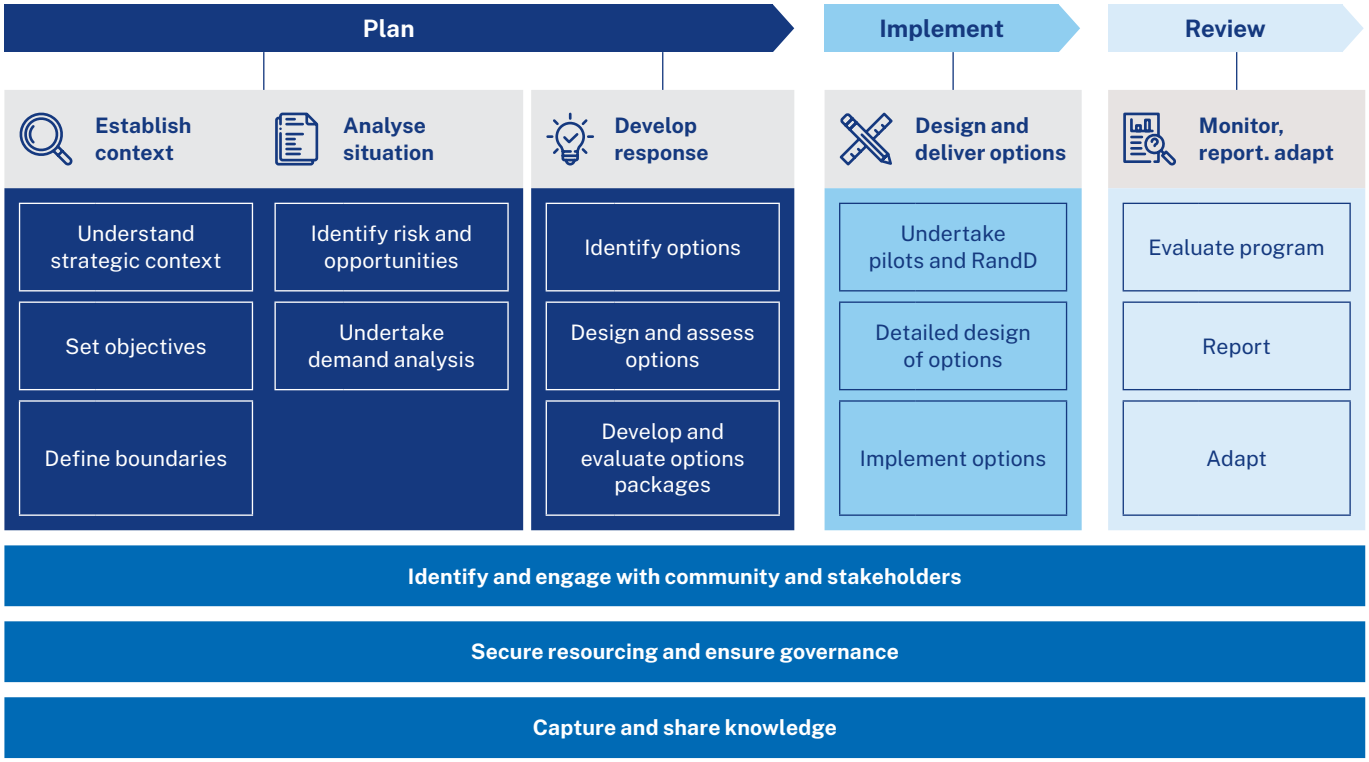
2.1.2 NSW Water Efficiency Framework

The NSW Water Efficiency Framework is a best-practice guide to assist government, water utilities, councils, and large businesses develop and deliver water conservation programs. Water conservation is a core component of supply and demand planning and integrated water cycle management (IWCM). However, the framework recognises that water conservation programs are sometimes conducted in parallel with, or independently of, supply planning or IWCM.

As shown in **Figure 3**, the framework consists of 3 overarching phases: plan, implement, and review. Below this are 5 elements to consider when developing and delivering water conservation:

- establishing the water conservation context
- analysing the current situation
- developing a water conservation response
- applying the water conservation response
- adapting it.

Figure 3: NSW Water Efficiency Framework



Source: NSW Department of Climate Change, Energy, the Environment and Water, NSW Water Efficiency Framework

Figure 3 shows that one of the 5 elements "developing a water conservation response" involves designing and assessing options. Cost-benefit analysis (CBA) is the primary tool for assessing options under these guidelines. NSW agencies are expected to apply the NSW Government *Guide to Cost-Benefit Analysis* when assessing government programs/initiatives including water conservation.[17] Local water utilities are expected to use CBA when evaluating measures and identifying solutions for water security under the NSW Department of Climate Change, Energy, the Environment and Water's *Regulatory and assurance framework for local water utilities*.[18]

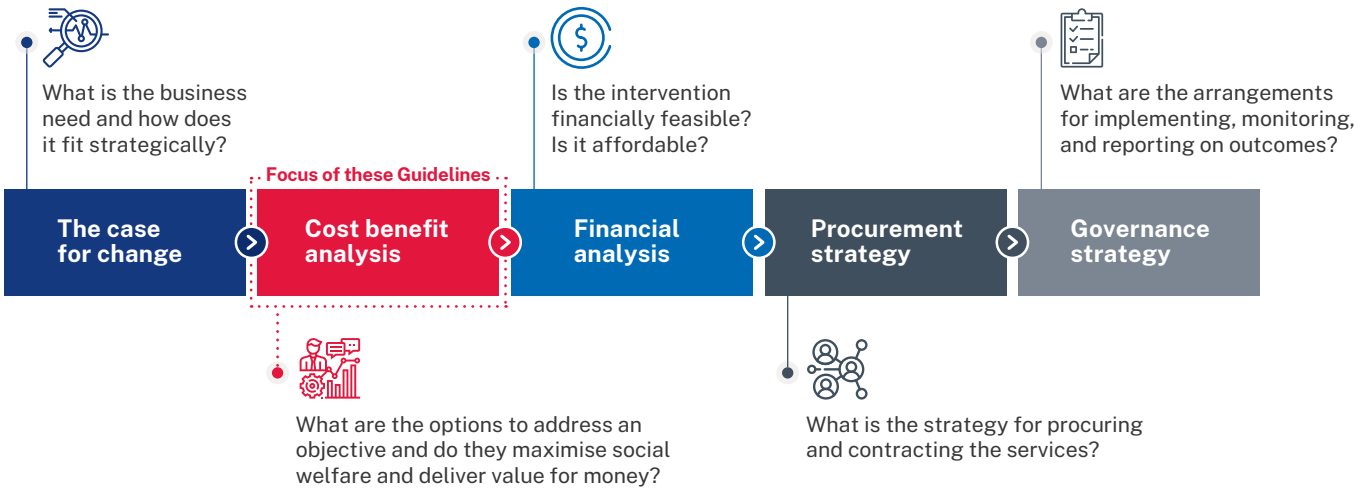
2.1.3 The role of cost-benefit analysis

CBA is a standard and well-accepted tool for systematically assessing the costs and benefits of a range of options available to address a business need or opportunity identified in the "case for change". A CBA identifies in monetary terms the option that maximises value from the perspective of the community – the relevant community in these guidelines being the entire NSW community.

As shown in **Figure 4**, CBA is a key component of a decision-making evidence base, such as a business case. But even in instances where a business case is not required, CBA can provide valuable insight into the value a proposed option to address a business need or opportunity delivers.

17 NSW Treasury, *NSW Government Guide to Cost-Benefit Analysis*, TPG23-08, 2023, p. 38.
18 NSW Department of Planning and Environment, *Regulatory and assurance framework for local water utilities*, July 2022.

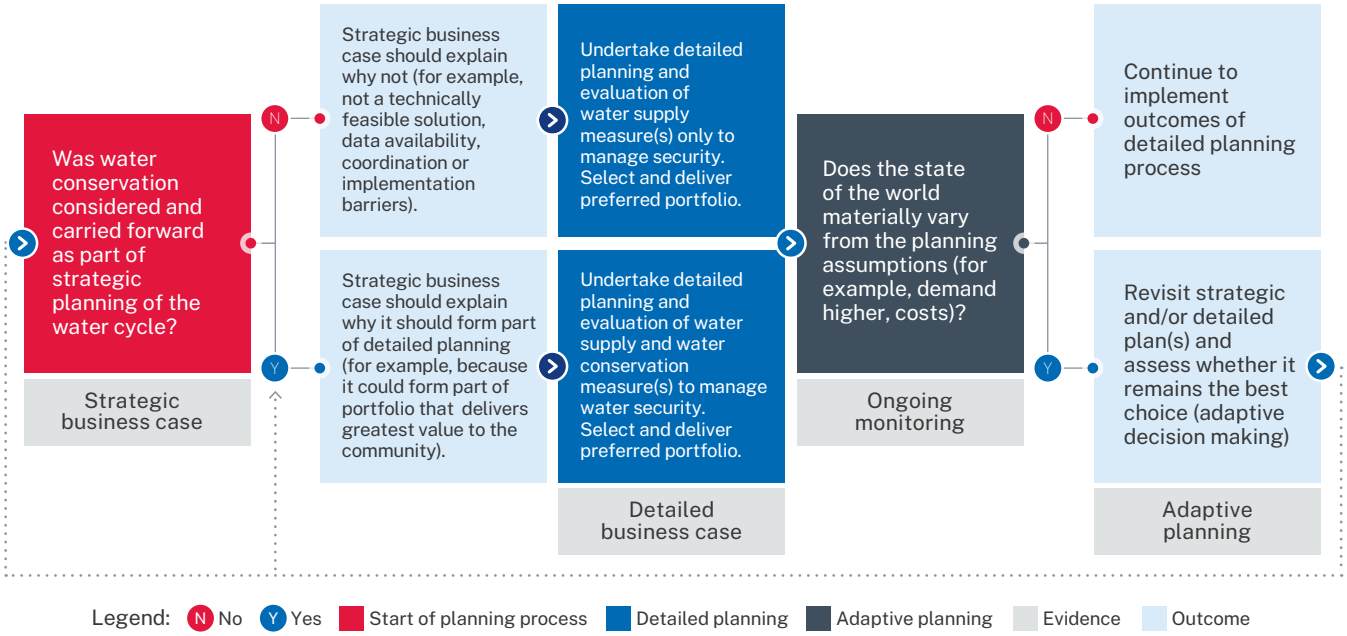
Figure 4: Cost-benefit analysis is a key part of the standard business case process



In practice, utilities should undertake a CBA as part of an adaptive decision-making process (see **Figure 5**) included as part of the:

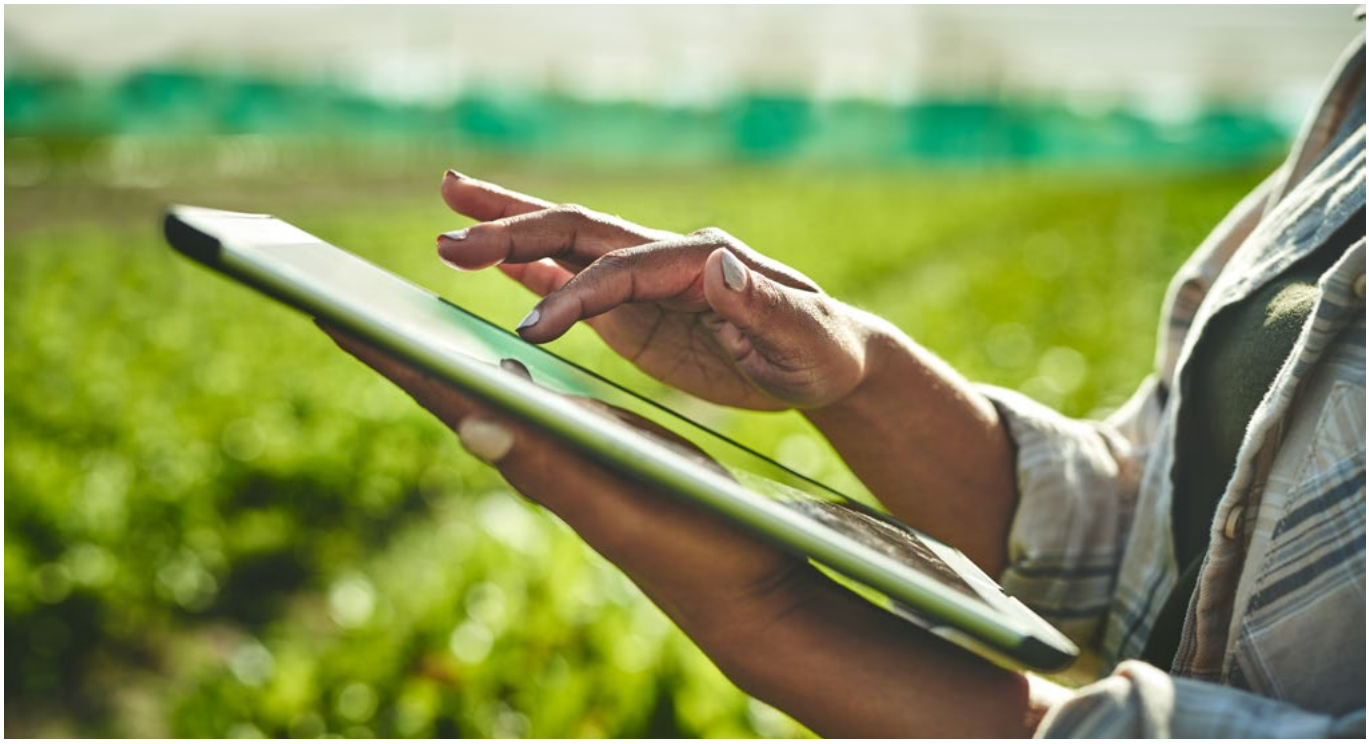
- strategic decision-making process upfront (for example, as part of developing a broad water security plan)
- detailed business case following the strategic business case
- ongoing adaptive decision-making process that responds to changes over time (for example, in relation to the availability and cost of options and/or their benefits).[19]

Figure 5: Water conservation as part of sound decision-making



19 As noted in Department of Planning and Environment's Guidance, a sound strategic decision-making process is adaptive and should never really "end". Rather, the utilities *"should use a circular process of regular iteration in response to new and emerging information in its operating environment to make, implement, monitor, and adopt strategic decisions."* Department of Planning and Environment, *Guidance on strategic planning outcome – Make and implement sound strategic decisions, Regulatory and assurance framework for local water utilities*, November 2022, p11. See website here: www.industry.nsw.gov.au/__data/assets/pdf_file/0011/545969/guidance-make-sound-strategic-decisions.pdf

2.2 Purpose of these guidelines and catalogue



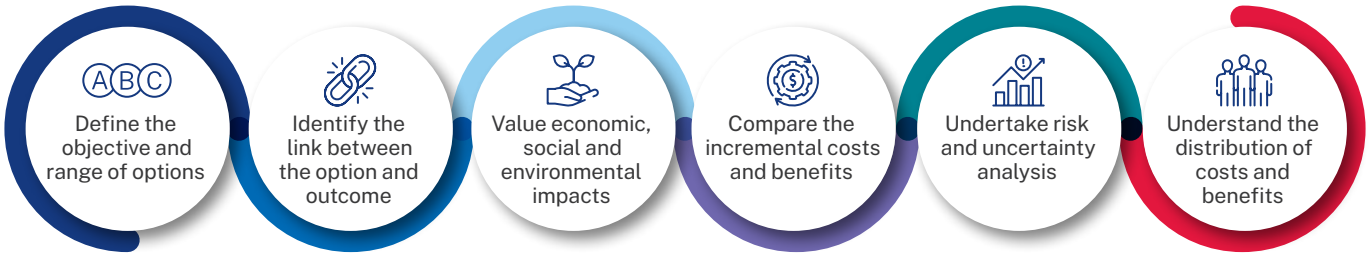
The NSW Department of Climate Change, Energy, the Environment and Water engaged Frontier Economics to help develop guidance material to support CBA of urban water conservation decisions across NSW, consistent with best-practice and relevant jurisdictional CBA guidelines[20]. This CBA framework material includes the following.

- A set of guidelines outlining the process for applying the 6 steps of CBA to water conservation measures (see **Figure 6**) (this document). Within each of these CBA steps, these guidelines cover the:
  - key concepts and issues in applying CBA to water conservation decisions drawing on the standard principles and processes articulated in NSW Government CBA guidelines
  - practical "do and don't" tips as well as examples of valuation methodologies
  - overview of the 3 case studies and other worked examples (see **Box 2**)
  - checklist of steps and processes for user to consider before completion.
- A set ("catalogue") of input assumptions for use in quantifying costs and benefits with associated evidence.[21] (see **Box 3**)
- Three detailed worked examples (case studies) with Excel-based CBA calculations and results.[22]

Importantly, this CBA framework will not provide guidance on how to fund water conservation measures or how to draft a business case consistent with stakeholder expectations to support decision-making. The *NSW Water Efficiency Framework* published by the Department of Planning and Environment provides relevant guidance on these areas.[23]

20 Such as NSW Treasury's NSW Government Guide to Cost-Benefit Analysis (2023) and Department of Planning and Environment's Regulatory and Assurance Framework for Local Water Utilities (2022).
21 Department of Climate Change, Energy, the Environment and Water (2024), Catalogue of values for costs and benefits of water conservation.
22 Department of Climate Change Energy, the Environment and Water (2024), Case studies A-C, extracted from the *Water conservation cost-benefit analysis guidelines*.
23 NSW Government (2022), NSW Water conservation Framework, www.dpie.nsw.gov.au/__data/assets/pdf_file/0010/538759/water-efficiency-framework.pdf

Figure 6: Six broad steps to cost-benefit analysis covered in this framework



Box 2: This CBA framework uses 3 indicative case studies

To enhance the accessibility of this framework, we have developed 3 indicative case studies covering a broad range of potential approaches to water conservation in different contexts across NSW.

1. Case Study A: Coastal metropolitan water utility servicing 750,000 customers (See **Appendix 6**).
2. Case Study B: Inland LWU servicing 2,500 customers (see **Appendix 7**).
3. Case Study C: Inland LWU servicing 15,000 customers (see **Appendix 8**).

We designed these case studies to test the **additional value** that water conservation provides if it complements existing measures. The results of the CBA illustrate whether the **additional benefits** of water conservation outweigh the **additional costs**. **Additional benefits** relate to upfront and ongoing conservation costs. **Additional costs** relate to deferring these supply and demand side measures under the long-term and drought-response plan.

It is important to note these are indicative and for illustration purposes only. We monetised the key material costs and benefits for each case study, and qualitatively included other relevant economic, social, and environmental impacts.

For each of these case studies, this framework sets out methods to:

- apply CBA steps, including problem definition and objective, options definition, and valuation of costs, benefits, and results
- design a CBA model, including the calculations and results.

Relative to these indicative case studies, users of these guidelines undertaking real-world CBAs may need to apply more analytical effort. This may include providing more supporting detail depending on the scale, risk, and community impact of the different approaches to water security planning and the water conservation measures considered.

Box 3: This framework includes a catalogue of input assumptions for use in quantifying costs and benefits of water conservation

The catalogue summarises a range of public information that may be applicable to users of this guideline in seeking to quantify the costs and benefits of water conservation. This includes assumptions related to the appropriate price (or value) of key impacts required to monetise (convert to a dollar amount) costs and benefits of water conservation.

Importantly, users can adopt some of the values in the catalogue to value multiple impacts. An example would be using long-run marginal cost estimates to value avoided water supply costs arising from reduced demand from a water-saving showerhead and reduced leakage. In these instances, users should review these guidelines to determine which impact is applicable in which situation.

We have not designed these guidelines and the supporting catalogue to act as a "complete" repository of all key possible CBA assumptions. Additional research may be necessary to identify project or site-specific information, including the following:

- Specific **biophysical changes** in economic, social, and environmental outcomes from water conservation investments. These are often represented as a quantity, for example, volume of water saved, amount of energy or greenhouse emissions avoided, biophysical changes in receiving water.
- Specific **system performance** changes relating to the likelihood of outcomes occurring, for example, changes in likelihood of water restrictions or a shortfall or likelihood of a flood event from water conservation reducing the draw on potable water systems.
- Other values (or prices) in instances where public information is not available or appropriate to use across multiple sites. This could include:
  - customers' willingness to pay for specific outcomes
  - other specific impacts such as the avoided costs of **specific** business disruptions or impacts on community mental health from supply shortfalls.

In these instances, users should consider including the impact qualitatively in absence of accessing site-specific quantitative data (see **Section 7.4**).

2.3 What's involved in cost-benefit analysis?

CBA is a systematic method to assess the incremental benefits and costs of potential investment options to address a business need or opportunity from the perspective of the community. Water conservation is an example. CBA considers a broad range of costs and benefits that affect the community, including:

- **economic costs and benefits**, such as costs of the water conservation initiatives and cost saving associated with providing other water services or wastewater services
- **social or liveability-related costs and benefits**, such as reduced or avoided cost on society of water restrictions or running out of water (supply shortfalls)
- **environmental and cultural costs and benefits**, such as improved waterway health arising from reduced wastewater or stormwater discharge, or reduced carbon emissions.

CBA has some key differences to the financial analysis (FA) in the business case (see **Box 4**).

Box 4: Cost-benefit analysis (CBA) vs financial analysis (FA)

CBA provides a holistic community or societal approach to investment decision-making. It compares economic, social, and environmental benefits and costs that accrue to the *NSW community* **and** converts it to a single discounted metric using the social discount rate.

FA provides a narrower cash-flow focus to investment decision-making. It compares the revenues and financial costs that *accrue to a single entity such as a council or a state government agency* **and converts it** to a single discounted metric using the entity's cost of capital discount rate. This is central to the "financial analysis" of the business case.

	Cost-benefit analysis	Financial analysis
Overview	• Explores the value for money of options through identifying the option that maximises the net benefits from the perspective of the community.	• Explores the affordability of options interventions for investors through identifying financial impacts of the options on the agency (and potentially government budget).
Detail	• **Cost-benefit analysis** (CBA): Compares in monetary terms the economic, social, and environmental costs and benefits of options to meet the objectives. • **Risk and resilience analysis**: Focuses on variability of CBA results under various states of the world. • **Distributional analysis**: An extension to CBA that sets out the distribution of costs and benefits across the community.	• **Funding analysis**: Drawing on distributional analysis, it identifies potential sources of funding considering both impactor and beneficiary pays frameworks. • **Financial appraisal**: Evaluates whether based on the funding analysis, the proposed project is financially viable from the perspective of the investor.
Example	• Captures community value created by reducing the augmentation of water infrastructure "footprint", which increases opportunities for other uses of land.	• Captures the financial transfers including cash "outflows" from the cost of infrastructure, land acquisition, and tax as well as cash "inflows" from rates and charges.

Focus of CBA framework

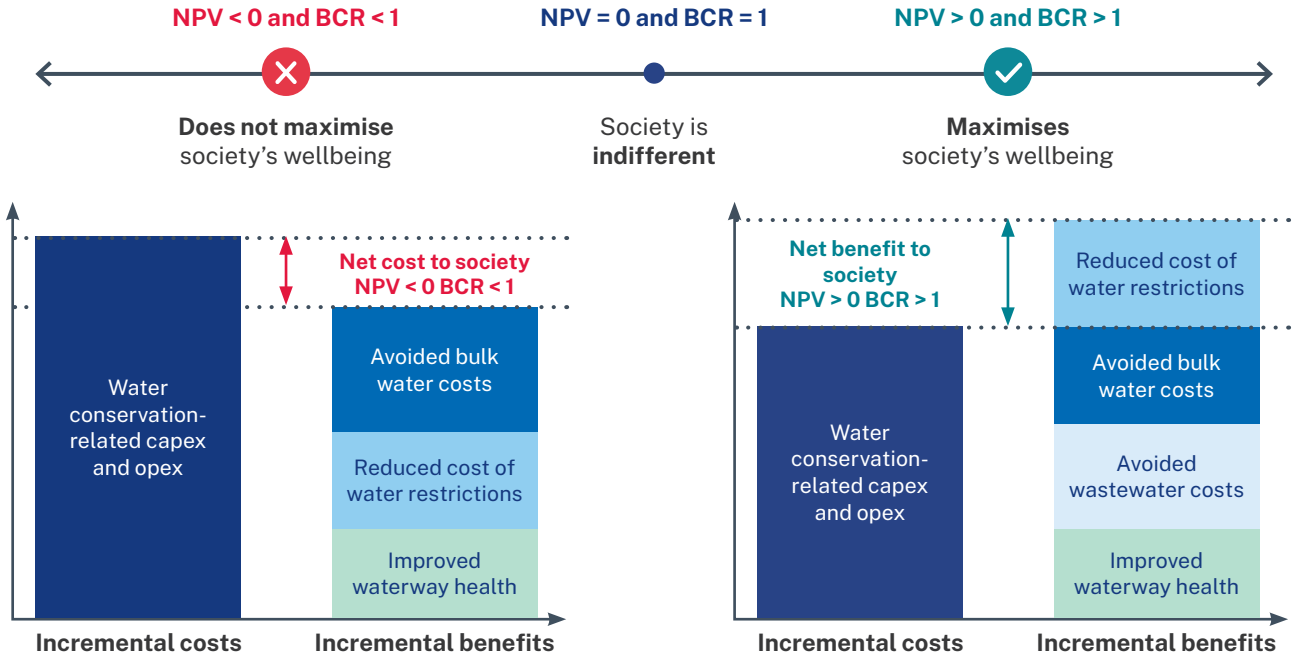
To compare the incremental economic, social, and environmental costs and benefits that accrue to the NSW community over time, CBA:

- as much as practical, converts each **annual** cost or benefit to a monetary (dollar) value, without any double counting
- compares these annual values to the base case to identify the **incremental** value to the community from pursuing "moving away" from the base case (that is, from doing something other than the base case, which is often but not always a "business-as-usual" approach)
- discounts this stream of annual values using a social discount rate to a single metric. It presents this in:
  - **net present value** (NPV) terms – present value of economic, social, and environmental benefits minus present value of economic, social, and environmental benefits costs over the period
  - **benefit-cost ratio** (BCR) terms – present value of economic, social, and environmental benefits divided by present value of economic, social, and environmental benefits costs over the period
- qualitatively includes impacts that cannot be quantified and monetised.[24] This qualitative assessment should include decisions around the likely direction of impact and significance, without formal weightings.

As shown in **Figure 7**, the option with the largest expected NPV[25] and BCR generates the largest incremental benefit to the community (compared to the base case). In particular:

- **NPV > 0 and BCR > 1 indicates the option results in an expected net benefit** to the community relative to the base case – incremental benefits of the option exceed incremental costs
- NPV = 0 and BCR = 1 indicates the incremental benefit of the option exactly equals its incremental costs
- **NPV < 0 and BCR < 1 indicates the option results in an expected net cost** to the community relative to the base case – incremental costs of the option exceed incremental benefits.

Figure 7: Cost-benefit analysis involves evaluating the options that generate higher net benefits to the community – an illustrative example



24 CBA does not require all costs and benefits to be quantified and monetised.

25 These guidelines include the use of expected NPV to ensure the benefits that water conservation provides in reducing the severity of key risks and uncertainties such as drought and flooding can be valued. For more detail on expected NPV see Section 8.2.3.

2.3.1 When is cost-benefit analysis required?

CBA is the preferred approach for the economic evaluation of all policy, regulatory, or investment decisions in NSW, including water conservation decisions. The following reflect this:

- NSW Government's *Business Case Guidelines* and NSW Treasury's *NSW Government Guide to Cost-Benefit Analysis*.[26]
- The operating licences for Sydney Water and Hunter Water, which require them to implement water conservation measures that have been assessed as economic under the approved Economic Level of Water Conservation (ELWC) method or another economic method approved by IPART.[27]
- Department of Climate Change, Energy, the Environment and Planning's *Regulatory and Assurance Framework for Local Water Utilities* in which local water utilities are expected to undertake strategic planning to a reasonable standard. Among others, this includes the use of CBA when evaluating measures and identifying solutions to deliver services to customers.[28]

However, **the extent of analysis undertaken for a CBA should match the size, complexity, level of risk, and estimated cost on a case-by-case basis**. That is, CBA should be "fit for purpose" given the proposed option(s).

Undertaking CBA need not necessarily be complex, detailed, or expensive. Even a simple CBA can be informative and cost-effectively support decision-making. We know this because a CBA "framework" is primarily a process for organising the available information in a logical and methodical way to support decision-making. It requires proponents to be clear about the objective (what are we seeking to identify), the potential options for achieving the objective, and the transparent and objective evaluation process they follow when comparing these options.

We discuss this in more detail below. A simple CBA may be appropriate in cases where it may not be feasible to quantify and monetise all economic, social, and environment outcomes of a proposed investment.

However, in some cases, the need or objective, and the size and scope of the investment options may warrant a more detailed CBA. If so, proponents may require further technical guidance and specific expertise to assist in developing or reviewing key aspects of the CBA. Examples of projects a complex CBA could support include assessment of options in a highly uncertain environment to deliver water security. In this scenario, each option has significant lead time and/or long-lived assets that make the investment decision irreversible.[29] This could be a decision about committing to a large new water supply source or wastewater infrastructure upgrade. Or upgrading existing infrastructure. Water conservation in these contexts could be an efficient or value-enhancing way of delaying these decisions until further information is available that may reduce the uncertain outlook.

Importantly, as discussed in more detail below, even in cases requiring a detailed CBA, there is likely to be a spectrum of effort required given the relative scale of the investments and community interest.

26 CBA is mandatory to support a government funding or regulatory proposal for capital, recurrent, and information and communications technology (ICT) proposals with an estimated total cost of $10 million or higher.

27 Before using the ELWC method, Sydney Water and Hunter had targets for average water usage and/or Sydney system leakage.

28 NSW Department of Planning and Environment, *Regulatory and assurance framework for local water utilities*, July 2022. See website here: www.industry.nsw.gov.au/water/water-utilities/best-practice-mgmt/iwcm/how

29 For further information on real-options analysis as part of more complex CBAs see website here: www.frontier-economics.com.au/documents/2020/12/real-options-analysis-bulletin.pdf/