A Cost-Benefit Framework for Evaluating Investments in Improved Drinking Water Quality

An Australian Perspective

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NineSquared

Intelligent thinking.
Confident decisions.

Overview

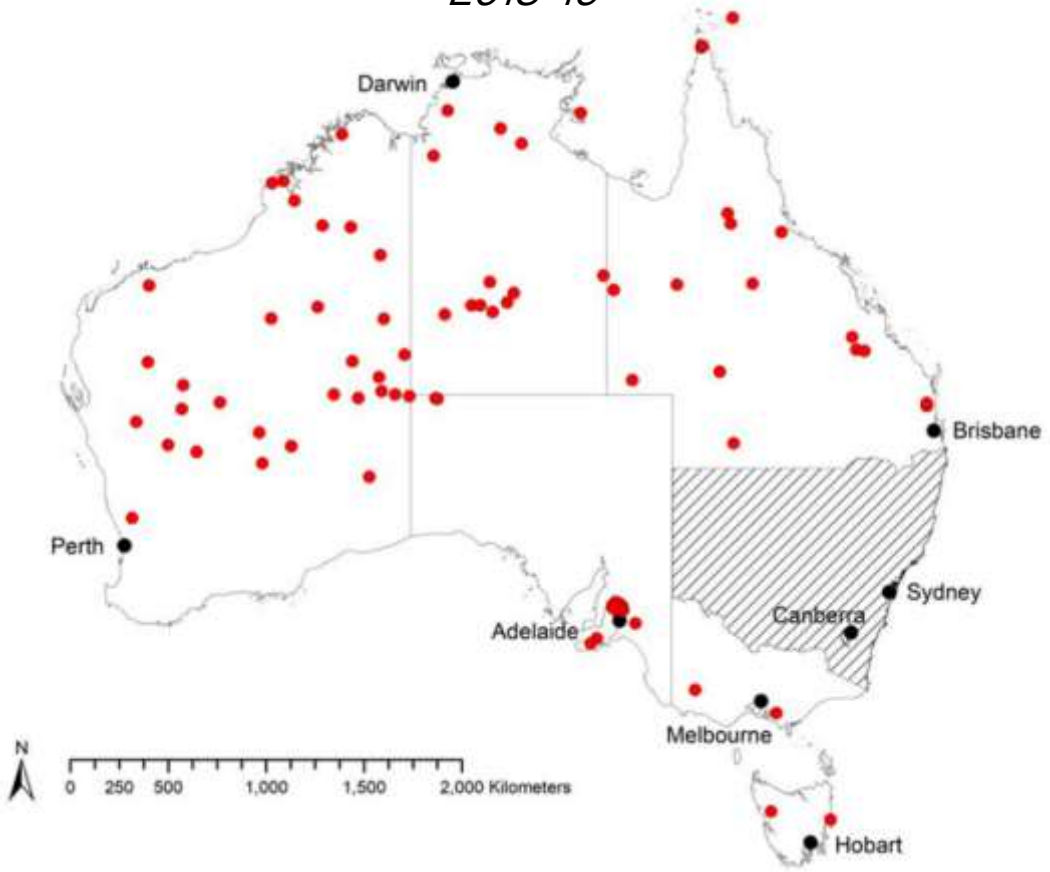
Study Goal

To develop a structured Cost-Benefit framework for evaluating investments aimed at improving drinking water quality in an Australian context.

Study Motivation

- Existing CBA frameworks **do not explicitly identify** the relevant costs and benefits of drinking water quality improvements
- Many **rural, remote, and Indigenous communities** lack access to water that meets minimum drinking water quality standards

There were over 115 locations that failed to meet the ADWG health-based values at least once in 2018-19



Source: Wyrwoll et al., 2024

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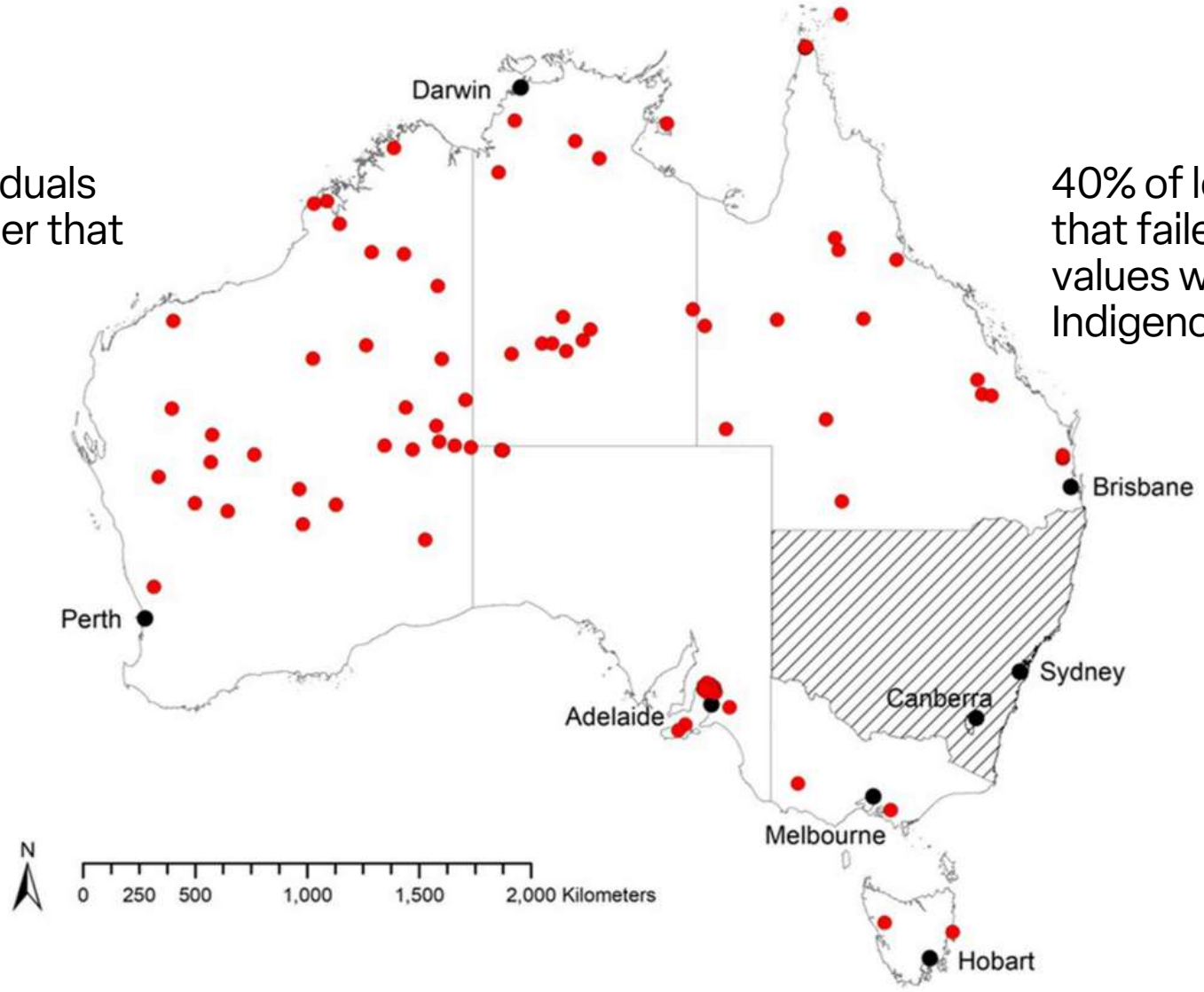
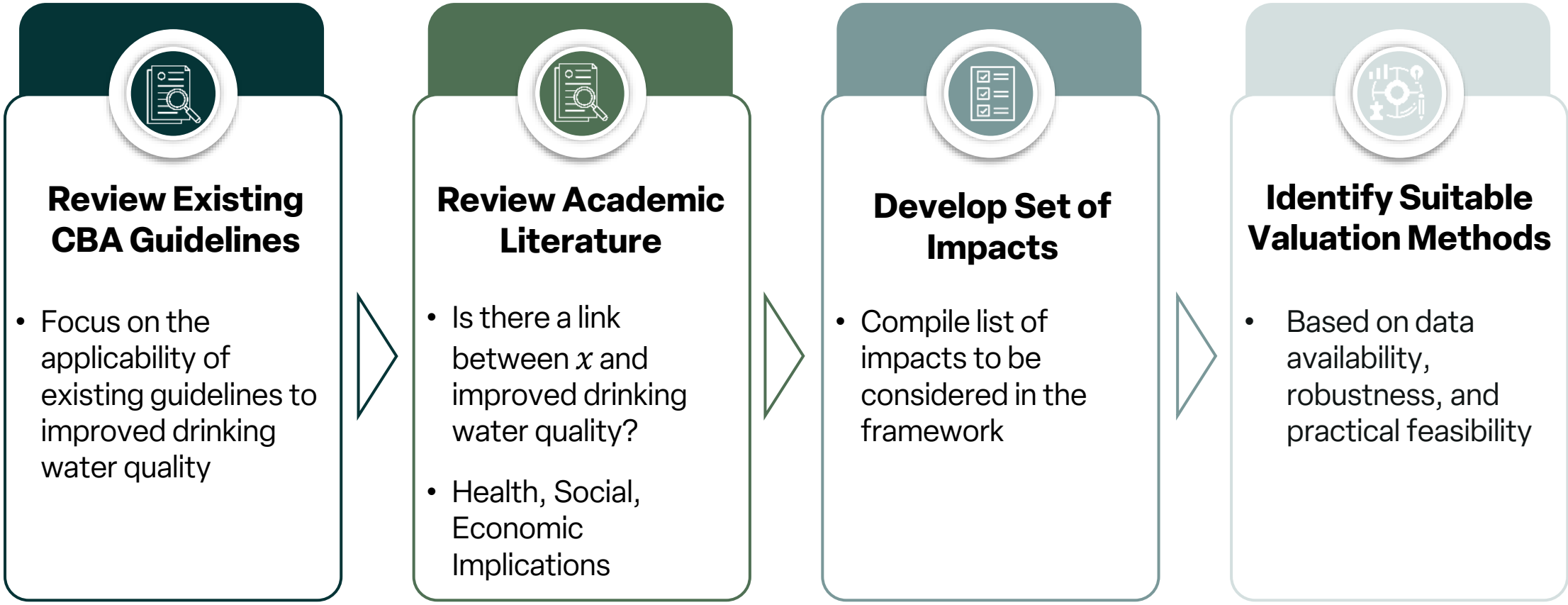
194,572 individuals accessed water that failed to meet guidelines



40% of locations that that failed to meet these values were remote Indigenous communities

Source: Wyrwoll et al., 2024

Approach to Framework Development



The Framework

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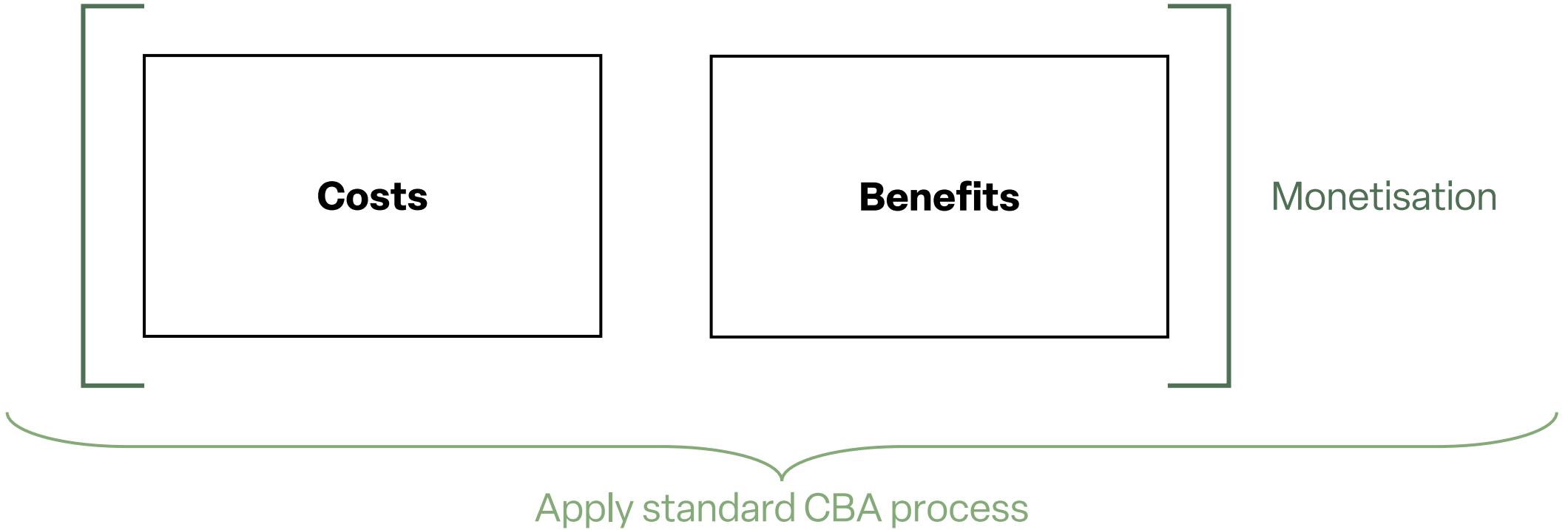
Overview of the Framework



Costs

- Relevant costs will differ depending on the type of project that is being evaluated

Infrastructure	
Example projects	**Cost categories**
• Water Treatment Plant upgrades /construction • Pipe and pump replacement • Storage upgrades • Desalination units • Catchment fencing/buffer zones	• CAPEX • Construction • Design and planning • Procurement and installation • Maintenance costs • Decommissioning expenses

Service-Based	
Example projects	**Cost categories**
• Drinking Water Management Plan Development/Updates • Additional resourcing • Staff training • Emergency response protocols	• Consulting fees • Staff costs • Training costs • Ongoing technical support

Benefits

Improved Efficiency and Financial Impacts

- Avoided cost of alternative sources of drinking water
- Avoided capital and operating costs
- Reduced administrative burden

Community Benefits

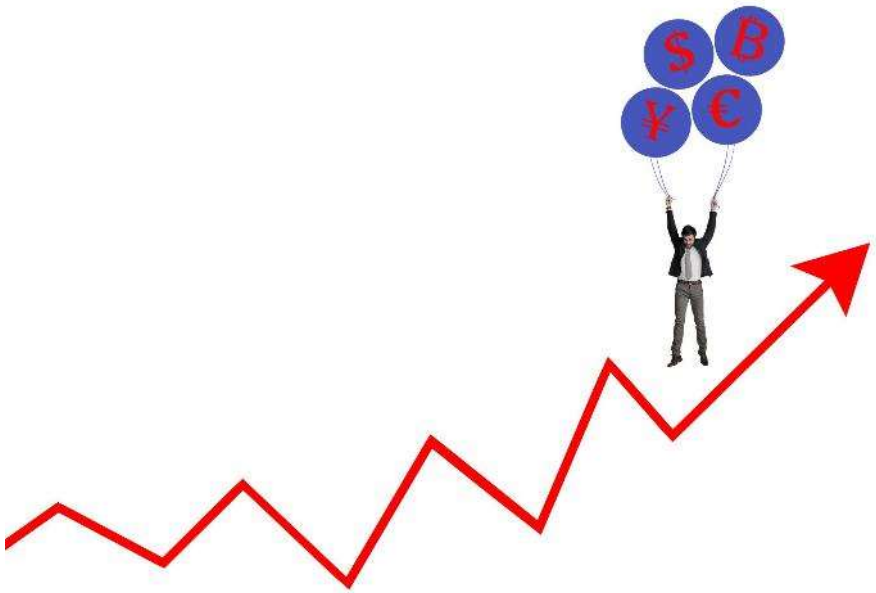
- Reduced time spent boiling or collecting water
- Avoided cost of illness from water-borne diseases
- Avoided cost of illness from Sugar-Sweetened Beverage Consumption

Other Impacts

- *Reduced greenhouse gas emissions
- Improved equity
- Residual value

*Unlike other benefits, it is likely that total GHG emissions with the project will be greater than without, and therefore comprise a **disbenefit**.

Valuation Techniques



Market-Based Approaches

Market-based approaches utilise observable market prices as a basis for estimating benefits. This method is effective where direct costs or savings can be identified.

Non-Market Valuation Techniques

Non-market valuation techniques, such as stated and revealed preference methods, are used to assess benefits that do not have market prices, providing alternative valuation methods.

Benefit Transfer

Benefit transfer involves applying existing valuation estimates from comparable studies to similar contexts, facilitating easier implementation when primary valuation is resource-intensive.

Qualitative Assessment

When monetisation is impractical, qualitative assessment provides a flexible approach for evaluating benefits based on expert opinions and stakeholder insights.

Improved Efficiency and Financial Impacts

BENEFITS	DESCRIPTION	SUGGESTED MONETISATION APPROACH
Avoided cost of alternative sources of drinking water	Improved drinking water quality reduces the need for households, businesses, and/or the government/water utilities to purchase bottled water or rely on other costly alternatives during water advisories.	Estimate the cost of alternative water sources including distribution costs – this could be supported by surveys. Financial transfers are to be excluded in the case that substitute water is supplied locally.
Avoided capital and operating costs	Improved drinking water quality reduces the need for households, businesses, and councils to invest in supplementary infrastructure or ongoing maintenance (e.g., water tanks, filtration systems, emergency repairs) to ensure potable supply.	Estimate expected household, business and community-level spending that is to be avoided with Project Options, informed by historical data and/or household surveys.
Reduced administrative burden	By reducing the frequency of water quality incidents, improved drinking water quality lowers the administrative workload associated with issuing advisories and managing emergency responses.	Estimate the reduction in staff time required for administrative tasks due to improved water quality and value this time using the prevailing wage rate.

Improved Efficiency and Financial Impacts

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Bottled Water

Water Carting

Refillable Water Containers

Community Benefits

BENEFITS	DESCRIPTION	SUGGESTED MONETISATION APPROACH
Avoided cost of illness from Sugar-Sweetened Beverage Consumption	Access to quality drinking water reduces substitution with SSBs, reducing rates of diet-related illnesses (e.g., diabetes, obesity, dental caries, cardiovascular disease).	Estimate the reduction in diet-related illness incidence due to improved water quality and apply the associated cost per case, including direct and indirect health costs. Cost per case may be determined via bottom-up or benefits transfer approach if a suitable similar study is available.
Avoided cost of illness from water-borne diseases	Improved drinking water quality lowers the risk of contracting water-borne illnesses, reducing direct healthcare costs and indirect costs incl. productivity losses and reduced quality of life.	Estimate the reduction in waterborne illness incidence due to improved water quality and apply the associated cost per case, including direct and indirect health costs. Cost per case may be determined via bottom-up or benefits transfer approach
Reduced time spent boiling or collecting water	Improved drinking water quality reduces the time spent boiling or collecting potable water from alternative sources (e.g., shops, refill points etc.).	Estimate time saved by households no longer boiling or collecting water, to which an estimate of VOT can be applied.

Community Benefits

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SSBs include beverages such as cordials, juices, energy drinks, soft drinks

Other Impacts

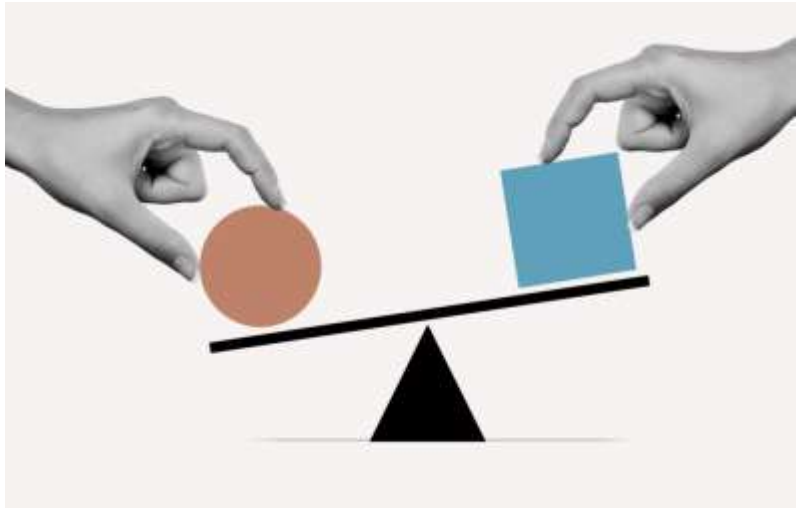
BENEFITS	DESCRIPTION	SUGGESTED MONETISATION APPROACH
Reduced greenhouse gas emissions	Improved drinking water quality may reduce the GHG emissions associated with Base Case activities (e.g., water carting, boiling water)	Estimate incremental GHG-emissions in the Project Option relative to the Base Case, to which a carbon value is to be applied.
Improved equity	Enhancing drinking water quality addresses service disparities affecting remote and disadvantaged communities, particularly those with high First Nations populations.	Qualitatively assess, supported by evidence of public value placed on improved equity → a survey found Australians are willing to pay between $324 and $847 per year, for 10 years, to ensure good drinking water for all
Residual Value	If at the end of the analysis period, a salvage or scrap value can be attributed to the asset(s), this should be reflected in the residual value which is attributed as a benefit at the end of the analysis period	Apply straight-line depreciation to determine remaining asset value if it has not reached the end of its useful life. If an asset has salvage or scrap value at the end of its life, this should be factored into its residual value.

Results of the CBA

Key Results

- NPV – Net Present Value
- BCR – Benefit Cost Ratio

Where:
Benefits outweigh costs when NPV > 0 or BCR > 1



This framework is not intended to justify inaction when BCR<1 or NPV<0.

The purpose is to prioritise, compare, and understand.

Conclusion

Structured CBA Framework
The framework provides a structured template for applying cost-benefit analysis in investments for improved drinking water.

Incorporating Non-Market Impacts
It incorporates non-market impacts like health benefits and time savings, alongside traditional impacts such as real cost savings

Flexibility in Valuation Methods
The framework offers flexible valuation methods suitable for data-poor contexts, enhancing its applicability to real-world projects.

Foundation for Future Guidelines
The framework sets the stage for developing comprehensive guidelines for conducting CBA on investments in improved drinking water quality.

Advancing Public Health and Equity
By ensuring that the full value of safe drinking water is recognised, the framework contributes to advancing public health and social equity in historically underserved communities.

Thank you.

Any Questions?